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THE FAR EASTERN REVIEW

ENGINEERING FINANCE COMMERCE

GOING BACK TO PORTSMOUTH

A CONSPIRACY OF SILENCE

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PEKING TRAMWAYS

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SHANGHAI, PEKING, TOKYO AND MANILA

The Far Eastern Review

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VOL. XX SHANGHAI, JUNE, 1924 No. 6

Going Back to Portsmouth

A CONSPIRACY OF SILENCE

By Geo. Bronson Rea

Further Reflections on Basic Far Eastern Problems After Reading a Book Entitled "Conflict of Policies in Asia" by Thomas F. Millard, Published by the Century Company of New York

DR. THOMAS F. MILLARD has written another book. This time he entitles it "Conflicts of Policies in Asia" but after a careful perusal of its contents we come to the conclusion that the conflicts are largely the result of clashes of undigested ideas in the mind of the author. At least half of the book is devoted to the publication of "confidential" memoranda written by Mr. Millard on every conceivable phase of Far Eastern problems, leaving the impression in the mind of the reader that American and Chinese state policies have been largely moulded and directed by this brilliant super-strategist whose chief aim in life seems to have been to embroil his own country in a war with Japan.

Mr. Millard is a self-confessed authority on Far Eastern affairs. He modestly admits this fact in several places in his new book and if he is taken seriously it would seem that his advice has been eagerly sought by American and Chinese statesmen to an extent which places him head and shoulders above all other experts in these problems. After reading the mass of confidential information covering every conceivable political, economical and strategical contingency in the Far East, we begin to realize how utterly insignificant are all other authorities on these subjects. It was only a few months ago that we reviewed a book written by Professor E. T. Williams, the official Far Eastern expert to the American government and condemned as worthless the chapters on international politics because he omitted the main evidence on which modern Far Eastern history should be based. We refer specifically to the Sino-Russian secret treaty of alliance of 1896 revealed officially for the first time by China at the Washington conference.

We remarked at the time that there existed a conspiracy of silence on the part of American and British writers concerning the existence of this important document, for if once emphasized, the sequence of events would vindicate Japan's policies in China and undermine the foundations of American policy in the Far East. Three American experts have written books on China since the Washington conference, yet with the records before them, ignored any mention of the evidence disclosed at that conference which would have given the world the proper perspective on Far Eastern problems. Mr. W. W. Willoughby, adviser to the Chinese government, published a very exhaustive report on "*China at the Conference*" faithfully covering all phases of the questions raised but rejecting the most important. Mr. E. T. Williams, the expert of the American government, did likewise. Now comes Mr. Thomas F. Millard and commits the same unpardonable error.

Mr. Millard gives the origins of the Manchuria question, as embraced in another of his numerous confidential memoranda to the Washington conference. He says "*Manchuria belonged to China: a condition which required the Russian government to negotiate a treaty with China for a railway right-of-way there. Such a secret treaty was negotiated in* 1895 *and came into effect in the following year. It took the form of an agreement between a Russian corporation, the Russo-Chinese Bank (created for the purpose) and the Chinese government, whereby the Chinese Eastern Railway was to be built.*" He then builds up his argument from the provisions of the railway agreement, but not one word about the objects or the provisions of the master treaty which preceded it. Neither in the text of his book or in its appendices does he quote that secret treaty of alliance.

Mr. Millard is either ignorant or careless. In the first place, the secret treaty was signed in May 1896, not in 1895. This, however, may be a typographical error, but nevertheless the oversight is proof of the slipshod manner in which Mr. Millard marshalls his facts and then distorts them to support his perverted ideas on the situation. There is absolutely no excuse for him to ignore the filing and the text of the treaty. In Appendix H of his book he quotes from Professor Willoughby's report on the conference giving the tentative list of inter-power agreements that had been entered into with reference to China and which China desired to have cancelled. We mention this as it leads us to believe that Mr. Millard scrupulously avoided a study of the official minutes of the conference on the limitation of armament issued by the government printing bureau at Washington. Professor Willoughby took the above information from page 1152 of this document and Mr. Millard took his from Professor Willoughby. If Mr. Millard had examined the official record he would have found on page 1414 the telegraphic summary of the treaty of alliance between China and Russia (May 1896) submitted by the Chinese delegation. He would also have noted that the Chinese delegates promised that they would send a copy of the full text of the treaty as soon as it was received, and he would also have noted that the official record makes no further reference to the treaty, by which it is to be inferred, the Chinese failed to carry out their promise.

Now it is a remarkable fact that notwithstanding the irrefutable evidence concerning the existence and object of this master treaty. not one American expert on Far Eastern affairs has been honorable enough to quote or draw deductions from it. In feigning ignorance of its importance and suppressing vital evidence concerning grave international issues and at the same time carrying on a propaganda calculated to create animosities and stir up strife a journalistic crime is committed that merits the severest condemnation. It is within our knowledge that the American state department is fully aware of the vital significance of this document; that official reports have been submitted to the government which fully support our own contentions that this is the key to the Chinese puzzle, the lid of the Pandora box the opening of which brought death to hundreds of thousands, bankrupted Japan and started China on the road to ruin.

Mr. Millard fully understands the gravity of ignoring the existence of treaties having a vital bearing on delicate international issues for in commenting on the deplorable truth that the American

Delegation went to the Paris peace conference in complete ignorance of the secret agreements between the other allied powers relating to China, he says :

" Without implying that President Wilson and Secretary of State Lansing must have known before they went to Paris about the Shantung and other interallied secret agreements, it can be demonstrated that they ought to have known. Some of the secret agreements had been published (not those about Shantung), and the existence of the Shantung agreements had been distinctly intimated by the agreements that were published. Most commentators assert, from a survey of the circumstances, that if President Wilson and Mr. Lansing did not know officially (that is, by being officially informed) of the secret treaties before they went to Paris, they must have known of them unofficially. Certainly there was sufficient ground for suspicion that such agreements existed for the American government, when it entered the war, to have made definite inquiries and to have insisted on definite answers. For the American government to have gone through the war and to have entered upon negotiations for peace lacking that information is, to say the least, a striking case of ineptitude."

We concur in this. It was the most striking case of official ineptitude in a long series of diplomatic blunders characterizing the Wilson administration. If the failure of the state department to unearth these facts is open to such severe criticism what is to be said of the expert who, with the official record before him, writes a serious book and deliberately suppresses the evidence which overturns his ponderous theories ? At least, there is some excuse for the government. Official ineptitude in this case can be laid to the door of an inadequate intelligence service which was hastily organized after the entrance of America into the war and staffed by men in the main sadly deficient in the rudimentary requirements of intelligence work, but there is no palliating excuse for one who poses as the chief American expert on Far Eastern affairs in overlooking a piece of evidence which the veriest tyro in our intelligence departments would have sensed as vital. To plead ignorance of the 1896 Sino-Russian treaty of alliance and its bearing on subsequent Far Eastern history is a frank confession of incompetency to discuss these problems while to utterly ignore it as having no bearing on the issues involved is a brazen acknowledgement of partisan pleading which places the author outside the pale of honorable journalism.

It is pure folly at this late date for any writer on Far Eastern affairs to commence his story with a railway agreement which is now officially accepted as the instrument which carried into effect the terms of an alliance aimed at Japan. It is significant that the Chinese delegation at Washington filed only a brief telegraphic resume of this document with the conference. Only by comparing this summary with the full text as disclosed by other authorities can we understand the reluctance of the Chinese to set forth in full the terms of an alliance which makes their country the full partner of Russia in provoking one of the most disastrous wars of history. Once more, we call attention to the text of the treaty as given in the official records of the conference on page 1414.

" Article 1.—The high contracting parties engage to support each other reciprocally by all their land and sea forces in case of any aggression directed by Japan against Russian territory in Eastern Asia, China and Korea.

" Article 2.—No treaty of peace with an adverse party can be concluded by either of them without the consent of the other.

" Article 3.—During military operations all Chinese ports shall be open to Russian vessels.

" Article 4.—The Chinese government consents to the construction of a railway across the province of Amur and Kirin in the direction of Vladivostock. The construction and exploitation of this railway shall be accorded to the Russo-Chinese Bank. The contract shall be concluded between the Chinese minister at St. Petersburg and the Russo-Chinese Bank.

" Article 5.—In time of war Russia shall have free use of the railway for the transport and provisioning of her troops. In time of peace Russia shall have the same right for the transit of her troops and provisions.

" Article 6.—The present treaty shall come into force from the day on which the contract stipulated in Article 4 shall have been confirmed. It shall have force for fifteen years."

Let us compare this with the version given in McMurray's compilation of *Treaties and Agreements with and Concerning China*. On page 81, we find the following :—

" In an article entitled 'Manchuria—A Chinese View of the Situation' by 'An Admirer of Li Hung Chang,' which was published in the London *Daily Telegraph* of February 15, 1910, it was stated that while attending the Coronation ceremonies of Emperor Nicholas at Moscow, in May, 1896, Li Hung Chang concluded with the Russian minister for foreign affairs (Prince Lobanoff-Rostovsky) a secret treaty of alliance, the French text of which was given together with the following English translation :—

" 'TREATY OF ALLIANCE BETWEEN CHINA AND RUSSIA. May 1896.

" 'Article 1.—Every aggression directed by Japan, whether against Russian territory in Eastern Asia, or against the territory of China or that of Korea, shall be regarded as necessarily bringing about the immediate application of the present treaty.

" 'In this case the two high contracting parties engage to support each other reciprocally by all the land and sea forces of which they can dispose at that moment, and to assist each other as much as possible for the victualling of their respective forces.

" 'Article II.—As soon as the two high contracting parties shall be engaged in common action no treaty of peace with the adverse party can be concluded by one of them without the assent of the other.

" 'Article III.—During the military operations all the ports of China shall, in case of necessity, be open to Russian warships, which shall find there on the part of the Chinese authorities all the assistance of which they may stand in need.

" 'Article IV.—In order to facilitate the access of the Russian land troops to the menaced points, and to ensure their means of subsistence, the Chinese government consents to the construction of a railway line across the Chinese provinces of the Amour (i.e., Heilungkiang) and of Guirin (Kirin) in the direction of Vladivostok. The junction of this railway with the Russian railway shall not serve as a pretext for any encroachment on Chinese territory nor for any infringement of the rights of sovereignty of his majesty the emperor of China. The construction and exploitation of this railway shall be accorded to the Russo-Chinese Bank, and the clauses of the contract which shall be concluded for this purpose shall be duly discussed between the Chinese minister in St. Petersburg and the Russo-Chinese Bank.

" 'Article V.—It is understood that in time of war, as indicated in Article I, Russia shall have the free use of the railway mentioned in Article IV, for the transport and provisioning of her troops. In time of peace Russia shall have the same right for the transit of her troops and stores, with stoppage, which shall not be justified by any other motive than the needs of the transport service.

" 'Article VI.—The present treaty shall come into force on the day when the contract stipulated in Article IV, shall have been confirmed by his majesty the emperor of China. It shall have from then force and value for a period of fifteen years. Six months before the expiration of this term the two high contracting parties shall deliberate concerning the prolongation of this treaty.'

" The substantial accuracy of the disclosure thus made would appear to be adequately confirmed by the following extract translated from *Ma Mission en Chine* : 1893-1897 (Paris, Plon-Nourrit, 1918), by M. A. Gérard, who during the period indicated was French minister to China :

" Although the treaty was intended to remain secret, I one day had in my hands for a few minutes, during a visit which I made in the spring of 1897 to Li Hung Chang at his residence in Peking, the copy of the document which he had signed the previous year with Prince Lobanoff. The English translation of this text was published fifteen years later, when the treaty itself had expired, in the London *Daily Telegraph*, by the son of Li Hung Chang, Li Ching Mai, who was then Chinese minister at the court of St. James, and who sought to defend his father's memory against unjust attacks. The treaty was in fact a treaty of alliance, concluded for a period of fifteen years, by which the Chinese government obligated itself, in the event of an aggression by Japan, to place at the disposal of the Russian government its ports and all means of defence. The principal clause of the treaty was the assent given by the Chinese government to the construction and operation, in the Manchurian provinces of Amur (Heilungkiang) and Kirin, of a line of railway connecting with the Russian Siberian lines, the concession for which was made to the Russo-Chinese Bank by a contract to be signed between the Chinese minister at St. Petersburg and the delegate of the Bank

(Article IV). It was stipulated in Article VI that the treaty should come into force on the day on which the contract for the construction and operation of the railway should have been approved and ratified by the emperor of China. . . .

"The English newspapers at Shanghai had published, long before it was signed, the alleged text of the treaty and of the contract. They published another so-called version in the month of October, 1896, some days after the ratification at Peking of the contract in regard to the railway. These various texts, to which the English press gave the name of the 'Cassini Convention,' were apocryphal. They confused the treaty of alliance, properly so called, with the railway contract. . . . The true facts as here outlined establish that there never was, properly speaking, any 'Cassini Convention'; that the treaty of alliance was concluded at St. Petersburg in the month of May, 1896, between Li Hung Chang and Prince Lobanoff; that the railway contract was signed on September 8 following, also at St. Petersburg, by the Chinese minister, Shu Ching Cheng, and the delegates of the Russo-Asiatic Bank; and that it was this contract for whose definite ratification at Peking on September 30 Count Cassini waited before proceeding on his way to Russia."

The full version of the treaty leaves no room for doubt as to its purposes. Outwardly defensive in its opening paragraph it develops rapidly into an offensive arrangement which brought Russia into a position in Manchuria in order to drive the Japanese from Korea. In pursuance of its object and to facilitate the transport of Russian troops to the "menaced points" and to assure an uniterrupted line of military supplies, the Chinese government ceded to Russia the right to construct the Chinese Eastern Railway and surrendered its sovereignty over the railway zone. Later, in 1898, the concession and juridical rights were extended to cover a branch line from Harbin to Port Arthur and at the same time China presented her ally with a naval base at the latter point and gave her a lease to the Liaotung peninsula for twenty-five years. It all followed the original program laid down at St. Petersburg between Li Hung-chang and the Russian authorities. China's principal part in the alliance was to surrender her territory to the stronger military power. This she faithfully carried out before there could be any technical question as to the annulation of the treaty by Russia's participation in the Boxer campaign of 1900. China lived up to her end of the bargain and precipitated the Russo-Japanese war eight years later. These facts challenge refutation. They were available to Mr, Thomas F. Millard but in order to save himself and his previous books on Far Eastern questions from being discredited he persists in suppressing the truth.

* * *

Forcing the Issue

Unless all signs fail the time is not far distant when the world must give heed to the Sino-Russian treaty of 1896, that master piece of secret diplomacy which precipitated the spoliation of China, forced the Anglo-Japanese alliance, the battle of concessions of 1900, the declaration of the "open door" doctrine and the Russo-Japanese war. The conspiracy of silence will be broken when swift moving events compel Japan to fall back on the provisions of this pact and in the light of all that it implies and all that followed as a consequence thereof, demand a re-opening of the entire Manchurian question as the only way to bring about its peaceful and permanent solution. The recent recognition of Russia by China and the former's repudiation of all treaties concluded under the old Czarist *regimé* is but another step towards reviving the controversy over the Liaotung lease and Japan's rights in the South Manchuria Railway zone.

Japan is apprehensive that another move is being contemplated to challenge her position in Manchuria; that China will now claim that the lease and concessions inherited from Russia are void and jointly with Russia will insist that the 1915 Manchuria Treaty extending these rights to 99 years, be cancelled. China has already proclaimed this treaty null and void, and called upon Japan to evacuate the Liaotung peninsula. The recovery of the Chinese Eastern Railway as provided for in the recent Sino-Russian understanding will have far-reaching effects if any attempt is now made to coerce Japan into surrendering her rights in Manchuria. A re-opening of these issues based on the illegality of the treaties arising out of the twenty-one demands and Russia's repudiation of old treaties concerning China, must of a necessity carry them back to Portsmouth and a reconsideration of peace terms in which Japan was swindled out of the fruits of victory by the profound secrecy maintained by Russia and China concerning the existence of their alliance.

The issue is bound to arise and when it does it will not be a matter for an international conference or the intervention of any third party. It is matter which exclusively concerns the two principals, Japan and China, one which Japan refuses to discuss with other powers. There is little doubt what the verdict of world opinion will be when the facts of how Japan was buncoed out of her just indemnity at Portsmouth are made public. It is only necessary to recall the wave of indignation which swept over the United States when the American people learned how their government had been maintained in ignorance of the inter-allied secret agreements concerning the disposition of Shantung and the South Sea islands until long after the opening of the peace conference in order to realize that world opinion will stand by Japan when it learns how history has been perverted and Japan robbed of her just rights by the operation of a more sinister type of secret diplomacy which converted Manchuria into the cockpit of the Far East. American opinion justly condemned such tactics and insisted upon a reversal of the Shantung decision and rejected the Versailles treaty itself largely because its government had been made the victim of secret diplomacy. Had the American nation been forced into a disastrous war and brought to the brink of bankruptcy through the operation of secret diplomacy there is no uncertainty as to what their subsequent action would be. Not until the score was evened up and the slate wiped clean would they have been willing to call the account closed.

The Japanese delegates to the Washington conference wisely refrained from commenting upon the text of the secret Sino-Russian treaty when it was read aloud by Secretary Hughes and hurriedly pigeon-holed. It went into the records and stands there as the trump card in Japan's hand ready for her to play at any time China or Russia or the two nations combined questions the legality of Japan's rights in Manchuria. The American government was given firmly to understand before the convocation of the Washington conference that Japan would not consent to any discussion of her acquired rights in Manchuria as part of the agenda and in answer to Dr. C. T. Wang's bill of grievances against the powers which included a plea for the cancellation of the 1915 treaties, Mr. Hanihara very clearly announced this determination on the part of his government and added that it was a question between China and Japan to be taken up at another time. He was very clear on this point. When, later on in the conference Dr. Koo filed the telegraphic summary of the Sino-Russian treaty of alliance and the president hurriedly buried it by immediately taking up another subject, he played into the hand of Japan by making impossible any further discussion of the Manchurian problem before an international conference.

* * *

The Status of the Chinese Eastern Railway

IN view of the circumstances surrounding the convocation of the Washington conference and the general desire to befriend China, it is somewhat understandable why no American desired to stress the real status of a railway having its origin in a military alliance entered into to crush Japan. When it is recalled that the operation of the alliance which created the Chinese Eastern Railway and its branches was the compelling motive for the coming together of Great Britain and Japan in counter-alliance and that the Washington conference was convoked to effect amongst other things the termination of this alliance, it is also understandable why Mr. Hughes, after reading the telegraphic summary of the secret Sino-Russian pact of 1896 hurriedly shifted the subject by asking the delegates if any committee was ready to report. Secretary Hughes, as an expert authority on international law, undoubtedly grasped the full significance of China's official admission which firmly established as a historical fact what had hitherto been

revealed only in unofficial memoirs and newspaper articles and realized in a flash that any discussion of this important document would offset the arguments calculated to prove that the Anglo-Japanese alliance was the root cause of China's troubles and place the blame where it properly belonged. There was therefore every good reason for the chairman of the conference and his advisers to maintain a discreet silence. It was also natural that China's delegates should minimize its importance and divert attention from its bearing subsequent events.

This attitude is clearly shown in Dr. Koo's statement on the Chinese Eastern Railway made before the 6th plenary session of the conference on February 4 (two weeks after he filed the text of the secret agreement) in which he skilfully dodged the question by saying "I will not enter into the origin and the nature of the Railway Company." He could not honestly do this without citing the master-treaty. Further on in his statement Dr. Koo again diplomatically pointed out that the legal status of the railway was expressly defined in the agreements between China and Russia and between China and the Railway Company but avoided any reference to the date or character of the agreements between the two governments, as here again the only direct agreement between the governments of China and Russia concerning the construction of the railway was the secret treaty of alliance. The report of the sub-committee of technical advisers on the Chinese Eastern Railway submitted to the conference on January 23, declared that "the status of the railway is determined by the contract concluded in 1896 between China and the Russo-Chinese (Russo-Asiatic) Bank and the subsequent contracts concluded in 1898. As Dr. Koo did not file the telegraphic summary of the secret treaty until the following day (January 24) it is again clearly understandable why all official reports on the Chinese Eastern Railway submitted to the conference should be based on the assumption that its creation rested solely on the commercial convention, the only document permitted up to that date to appear in the public records. Attached to the above-mentioned report were certain observations and reservations made by Dr. Hawkling Yen, the Chinese representative on the sub-committee, in which he naively remarks that "the construction of this railway by the Russians was obviously for a strategic purpose" but carefully neglected to state the obvious nature of the strategic purpose as to do so would have brought his own country in as a full partner in the military enterprize.

It was true at the time the expert report on the Chinese Eastern Railway was drawn up that its status as far as the world was concerned was determined by the contract between China and the Russo-Chinese Bank but the minute Dr. Koo submitted to the conference the telegraphic summary of the secret alliance, the status of the railway was determined by this master-treaty signed four months prior to the commercial agreement. The character of the railway then changed from a purely commercial undertaking into a instrument of war and as such completely alters its status in international law. Although the master-treaty provides for the building of the railway for the express purpose of facilitating the access of the Russian land forces to the "menaced points" and to ensure their means of subsistance during hostilities, the commercial convention upon which its accepted status is based camaflouges its real purpose by stipulating in Article 8 that "*the company is responsible that the Russian troops and war materials despatched in transit over the line will be carried through directly from one Russian station to another without for any pretext stopping on the way longer than is strictly necessary.*" The commercial agreement designed to throw dust in the eyes of the world as to the real object of the railway was worded so as to create the impression that the transport of Russian troops was to be confined to their transit through Chinese territory from the Baikal to the Ussuri provinces of Russia and *vice-versâ* without stopping on the way, while the master-treaty clearly specifies that the transport of Russian troops to strategical points on the Korean border was the primary object of the enterprise.

In any further discussion over the status of this railway it would seem therefore that the claims of the powers other than China embraced in Resolution XIII of the Washington conference are secondary to the claims that may now be rightfully advanced by Japan to an equity in the property as legitimate spoils of war. Although because of the Portsmouth treaty this equity may not properly include the rights of Russia it can be made to cover those rights now claimed by China and ceded by her to Russia in the recent Koo-Karakhan convention. If China originally conceded the right to construct this railway and surrendered her administrative powers over the railway zone and at a later date leased a naval base and its contiguous territory to Russia all in conformity with the terms of an alliance aimed at Japan and by reason of the profound secrecy maintained concerning the existence of this document, escaped paying an indemnity for her participation in the war that ensued, and eleven years after the expiry of the alliance officially confesses her culpability, then it would seem that common justice requires that serious consideration be given to Japan's equity to a preferred position in the final disposition of the property.

The fact that the Manchuria question was not brought up at the Washington conference; that it was clearly left open as a matter which solely concerned China and Japan; that the conference neglected to discuss the bearing of the secret Sino-Russian treaty on the matters under consideration that would have clarified the situation, gives to Japan the unqualified right to protect her own vital interests when the time is opportune by entering into exclusive negotiations with China for a peaceful and permanent solution to the long-outstanding problems involved in her rights in that province inherited from Russia.

* * *

Justification of the 21 Demands

IF we seem to harp on a subject studiously ignored by other writers on Far Eastern affairs it is because we are convinced that no honorable or lasting solution is possible to these problems until the Sino-Russian secret treaty of alliance is accepted as the starting point of the negotiations. With an intimate knowledge of how events shaped themselves immediately after the signature of this treaty and how it provides the key to many otherwise inexplicable moves on the Far Eastern political chessboard which culminated in Japan's presentation of the twenty-one demands in 1915, we remain firm in our belief that only by China's recognition of her own faults accompanied by an honest desire to undo the damage occasioned by her secret diplomacy, can the world look forward to a prolonged era of peace and prosperity in Eastern Asia.

We do not censure Chinese statesmen or their many foreign advisers for putting the best foot forward and striving to conceal or minimize the far-reaching and grave consequences which followed the rash act of Li Hung-chang. We can appreciate how essential it is from the Chinese point of view to base their position in Manchuria on the railway convention and how vital to their interests it is to emphasize at every opportunity the injustice of the twenty-one demands. We can do this because it may be fairly said that nearly every argument denouncing these demands originated from the pen of the publisher of THE FAR EASTERN REVIEW who carried China's publicity campaign in America against the imposition of the demands in 1915. Much of the credit for enlisting the sympathy and support of the American people and their government in China's fight can be justly claimed by THE FAR EASTERN REVIEW. If at this late date we now hold other views it is because facts hidden from us at that time compel a radical and honest change of opinion.

We lay no claim to the title of Far Eastern expert but we may be pardoned for believing that no real expert in the ramifications of international policies in China as expressed through the intrigues of the various powers for railway concessions will dispute our right to speak with certain authority on these matters. The real story of China's troubles has never been told and we make bold to assert that it will never be chronicled by any of the many writers who for the past fifteen years have posed as authorities on Far Eastern affairs. There are just about six men alive to-day who could tell the inside story of the intrigues which split China into spheres of interest and nearly precipitated her partition. These men with one exception (I refer to Mr. J. O. P. Bland) have written no books. Their secrets are the secrets of their governments. Their memoirs will never be published.

These men knew there was a key to the Chinese puzzle and kept their own counsel. That key was not available for the ordinary writer until for the first time at the Paris peace conference the text of the secret Sino-Russian treaty of alliance was made public. Then, only three or four of the many Far Eastern experts gathered there recognized its real significance. Up to that time our own views inclined to the belief that the British railway program in

China followed a well defined policy of penetration that would ensure to Great Britain the lion's share of the spoils in the event of her collapse and partition. It was the Far Eastern expert of the British delegation who disabused our mind of this fallacy and gave us a diplomatic hint which led in a few days to the unearthing of the Li-Lobanoff secret treaty submitted to the conference by Sazanoff in support of certain Russian rights in Manchuria. The British expert is now the minister of his country to Peking and his concise and correct interpretation of Britain's motives in 1898 have since been publicly expounded by Mr. Balfour at the Washington conference. Great Britain was always on the defensive. The missing link was found and with this document it was an easy task to read aright the sequence of events which the world had accepted as a cold-blooded game of grab at the expense of China.

It was not difficult to follow step by step the unfolding of the stupendous drama which culminated in 1915 with Japan's demands upon China and to sense that under such severe provocation, Japan was justified in extracting such guarantees as would insure her security against any further menace through the violation of China's territories by foreign powers. This is too long a story to compress in a short magazine article of comment. If, however, we follow the tactics and reasoning of Mr. Thomas F. Millard, it can be demonstrated that Japan was either accurately informed, or at least should have been informed, of the existence and the terms of the secret Sino-Russian pact of 1896 when Minister Hioki unceremoniously handed the twenty-one demands to Yuan Shih-kai in January 1915. Certainly Japan had no knowledge of this document when she fought the war with Russia nor did she suspect its existence at any time during the progress of the Portsmouth peace negotiations. That she had grounds to believe that such an agreement was in force was furnished by the evidence of its practical operation. It is difficult to state with accuracy just when Japan became convinced of the existence of the treaty. It can be demonstrated that this truth was borne home to her diplomats when, after the expiration of the treaty, its full text was printed in the London *Daily Telegraph* as a contribution from Li Ching-mai (son of Li Hung-chang), Chinese minister at the Court of St. James at that time. Coming from such an authoritative source in an attempt to defend his father's memory against unjust attacks, the Japanese government was justified in accepting it as an official confession.

If, then, we assume that the Japanese government became aware in 1911 that it had been duped, betrayed into a war and brought to the verge of ruin and swindled out of just reparations through the operation of China's secret diplomacy and convinced as it was that Russia was preparing to resume the struggle, again utilizing the territory of China to launch her offensive, can Japan be justly censured for nursing a grievance until the opportune moment arrived to penalize China for her duplicity? We do not advance this argument as the real justification for the presentation of the twenty-one demands—they rest on more solid grounds—but if the chief publicity expert to the Chinese government and leader of the anti-Japanese agitators is permitted to advance such a line of reasoning in support of his own pet theories, the rule must work both ways. If at any time prior to the outbreak of the European war, Japan learned of the exact nature of the secret Sino-Russian treaty of alliance, was she not amply justified in adopting any measures to make China suffer in part as she had suffered because of China's actions? If a Millard argument is good for China, the same logic is good for Japan. If the American government, feeling that it was duped and unfairly dealt with during the war and at Paris by the operation of secret diplomacy which concealed the facts surrounding the inter-allied agreements regarding the disposition of Shantung and the South Sea islands belonging to Germany, and moved heaven and earth until its views finally prevailed at the Washington conference, is not Japan provided with a precedent for conducting an agitation and propaganda until the wrongs inflicted upon her by the operation of Sino-Russian secret diplomacy are righted? If there is any honor left among the nations; any sincere desire for a proper and lasting solution of Far Eastern problems, Japan must be accorded the justice now due to her.

* * *

The Bones Turn Blue

REVIVING issues which were ceremoniously interred at the Washington conference would seem like holding an inquest over a corpse to ascertain the cause of death. Well, that is not an unusual procedure. In China, they not only disinter the corpse but publicly cut the flesh from the bones, scrape and clean them and then boil them for hours. If the bones turn blue at the joints it is proof positive that the deceased came to an end by poison. The Chinese are very thorough in conducting their inquests. The time is close enough at hand to anticipate the inquest over the stinking mass that was hurriedly interred at Washington before the accused could be exonerated from the piled up charges of suborned witnesses. As far as China and America are concerned they seem determined to reject any evidence that might in any way mitigate their conception of the harshness of the twenty-one demands. The bones will have to be boiled.

The political wheel in its turning has once more brought to the top the man who as foreign minister in the Okuma cabinet was responsible for drawing up and enforcing these demands upon China. Viscount T. Kato is now the premier of Japan and there is every likelihood that during his tenure of office issues will arise involving a re-opening of the drama staged in Peking during the early months of 1915. From the Chinese and American viewpoint the sincerity of the Kato administration will depend largely upon his willingness to acknowledge that his former policies were wrong and to consent to negotiations looking towards the surrender of Japan's special rights in Manchuria—all that is left at this date of the twenty-one demands.

Events are rapidly forcing the issue. The recent Koo-Karakhan convention will embolden China to make further demands upon Japan based on the Soviet's repudiation of the old imperial treaties upon which Japan's position in Manchuria is legally based. In order, therefore, to preserve her vital interests in this territory Japan will be compelled to go behind the 21 demands, back to Portsmouth and still further into the past to find bed-rock and make her stand on the terms of the secret Sino-Russian alliance of 1896, the master-treaty which provides the key to modern Far Eastern history.

Then, and only then can a proper inquest be held and the story of China revealed to the world in its true aspect. With this document providing the key to what followed, Japan can piece together the events of the following years and fully vindicate herself before the world and demand proper reparations from China.

China's case rests squarely upon the single treaty resulting from the 21 demands. She does not go behind this document except in the case of the Chinese Eastern Railway whose status she asserts is determined by the railway convention of September 1896. The proof, however, is now officially recorded that the status of this railway convention is in turn determined by the master-treaty signed in May, 1896. Instead of an innocent commercial enterprise the railway stands clearly defined as an instrument of war fashioned secretly in order that China through Russia might be revenged upon Japan for her defeat in the war which terminated the year previous. The object of the railway was to crush Japan and bring her under the vassalage of Russia. Its cost of construction is offset many times over by the damages it occasioned to Japan in carrying out its specific purposes. In any court of justice Japan's claims to a large share in the control of the line must receive serious consideration.

With the evidence provided by the master-treaty and the still further proofs that can be submitted to prove its connection with the events which followed in rapid succession to undermine the sovereignty of China, the bottom is taken out of China's case against Japan in the 21 demands. The inquest will show that the bones have turned blue—that China was secretly administered poison and circumstantial evidence employed to fasten the crime upon Japan.

* * *

The Only Honorable Solution

THERE are many reasons involving the peace of the Far East and the interests of foreign commerce why these questions should be amicably settled as rapidly as possible in order that China and Japan can come together in some permanent understanding that will permit them to work out their destinies in harmonious co-operation. The American exclusion law closing the door to Japanese immigrants is the last act in a long-drawn-out

discriminatory program directed against all Asiatics. From the viewpoint of many Chinese there existed no good reason why the Japanese alone of all Asiatic peoples should be singled out for special treatment under our immigrations laws. It is probably a source of considerable satisfaction to this element to see Japan placed on the same basis of equality as other Asiatics but this feeling must in time give place to one that will throw them together for the preservation of their common civilization. The Chinese will remember when they have time to think about it that the act which excluded them from the United States was in violation of a treaty at a time when their weakness operated to make their protest a farce. They will be more likely to sympathize with Japan and look to her for support when the time arrives to press their joint claims to emigrate to lands now held as preserves of the white races.

For the present the main issue is that by excluding Japanese from the lands of the West they are turned back into Asia, and here, in order for her people to settle, own land, and live in peace with their neighbors, some special arrangement must be made with China. It is folly to believe that the Japanese will practice race suicide so the time will arrive when an outlet must be found for her mounting millions. The Japanese now realize that on their relations with China depends the economic life of their nation and the future of their progeny. In sheer self-defense Japan may decide that her only salvation lies in following the example of Russia, Germany and Austria and surrender her extra-territorial rights in exchange for privileges that will enable her children to own land and reside in the interior. If in pursuit of her own vital interests Japan should break away from the other powers whose doors are closed to her people and surrender her extra-territorial privileges in China, foreign domination and intervention in the affairs of this country will come to an abrupt end. It is true perhaps that the nationals of America, Britain and France could continue to conduct business under their present extra-territorial rights but the advantages enjoyed by their competitors would be so great as to ultimately drive them from the field.

Sooner or later extra-territoriality will be abolished in China. Once mistress in her own home and supported by Japan the influence hitherto enjoyed by foreign powers in this part of the world will disappear. This is probably one of the penalties the West must pay for its anti-Japanese agitations and Asiatic exclusion laws. Anything that throws China and Japan into a closer understanding and forces the latter to seriously ponder over the advantages to be gained by the surrender of extra-territorial rights, brings that much nearer the day when foreign influence in this country will become a thing of the past. China and Japan will come together despite the puny efforts of foreigners to keep them apart. American philanthrophy will not outweigh the natural attraction which draws two peoples of a common civilization into one unit for the preservation of their ideals and the right to exist in a world which is rapidly being divided into water-tight racial compartments.

China holds, as she believes, many grievances against Japan, all of which will disappear if approached in a sincere spirit to wipe out past differences in a new understanding. If Japan has erred, it can be proven that she labored under severe provocation and did what any other self-respecting nation would have done under similar circumstances. The fault can be laid to the door of China's own slipshod diplomacy and internal weakness. China may not need Japan's friendship at this time as much as Japan requires hers, but any fair inquest will disclose that China is deeply indebted to Japan for the damages inflicted upon her by the operation of the secret treaty with Russia. China will understand in time that the easiest and most honorable way to square the account is to frankly admit her mistakes and seek for some basis of an agreement that will close the doors to the past and open the way to a great and glorious future with the friendly support of Japan.

Japan is not in Manchuria of her own free will. China is solely responsible for Japan's presence in that province and owes her present sovereignty over the region to Japan's sacrifices. China must face the truth and gather the fruit of the seed she secretly planted in May 1896. On her frank admission of this mistake and a willingness to meet Japan in a new understanding based on the conditions of this historical document rests the only honorable solution to outstanding differences between the two nations.

Now It is the Cocopalm

For years the Chinese egg has been in bad odor on the Pacific coast although it arrives there in perfect condition so far as edibility and general excellence are concerned. The only trouble with it is that it is too cheap. Chinese chickens have acquired habits of frugality through the thousands of years since the first chicken laid the first egg or *vice versâ*, we are not concerned with the philosophical end of it, but it would appear that the Chinese fowl is a more efficient factory than the Pacific coast one and Petaluma rose in wrath, seeking to bar out the Chinese product. Bakers were compelled to put up signs saying that Chinese eggs were used in their products while their competitors were enabled to say "No Chinese eggs used here." And now a new "Yellow Peril" has arisen, we do not refer to the yolk of the egg—this time it is artificial butter that has to bear the brunt of Pacific coast inefficiency.

Once upon a time oleomargarine was fearfully and wonderfully made, a product that sometimes spread and at others simply curled its golden sheen around the butter knife much as axle-grease might do. In fact some declared that the only way they could tell whether it was margarine or axle grease was that the latter spread a little better. But the new coconut butters have changed all this and from the day in 1905, we believe, when Rocca, Tassy and de Roux churned up coconut oil and milk, sterilized it and made the first coconut substitute for butter, the margarine manufacturers have had not only to watch their step but take many steps for the proper preparation and purification of their product. Nowadays artificial butter is as pure and wholesome as that which comes from the cow via the churn. Purer perhaps, since no hand touches it from the time it enters the steam sterilizers until it emerges into the tins as a finished product. A firm in Oregon was the first to make a coconut oil butter and its use evidently is spreading to the detriment of the butter makers of the Pacific coast since they now have started a boycott against Philippine and other oriental vegetable oils, especially that of the coconut.

While they never will be able to stop the ingress of coconut oil into the United States, these poor benighted heathen of the Pacific coast (heathen being used in a strictly economic sense) have stirred up the Philippines government considerably and provoked the following five-headed *reclama* from the office of the governor general :—

1. Philippine oil that is exported is manufactured in modern mills that were put up only during the world war. These mills use up-to-date methods.

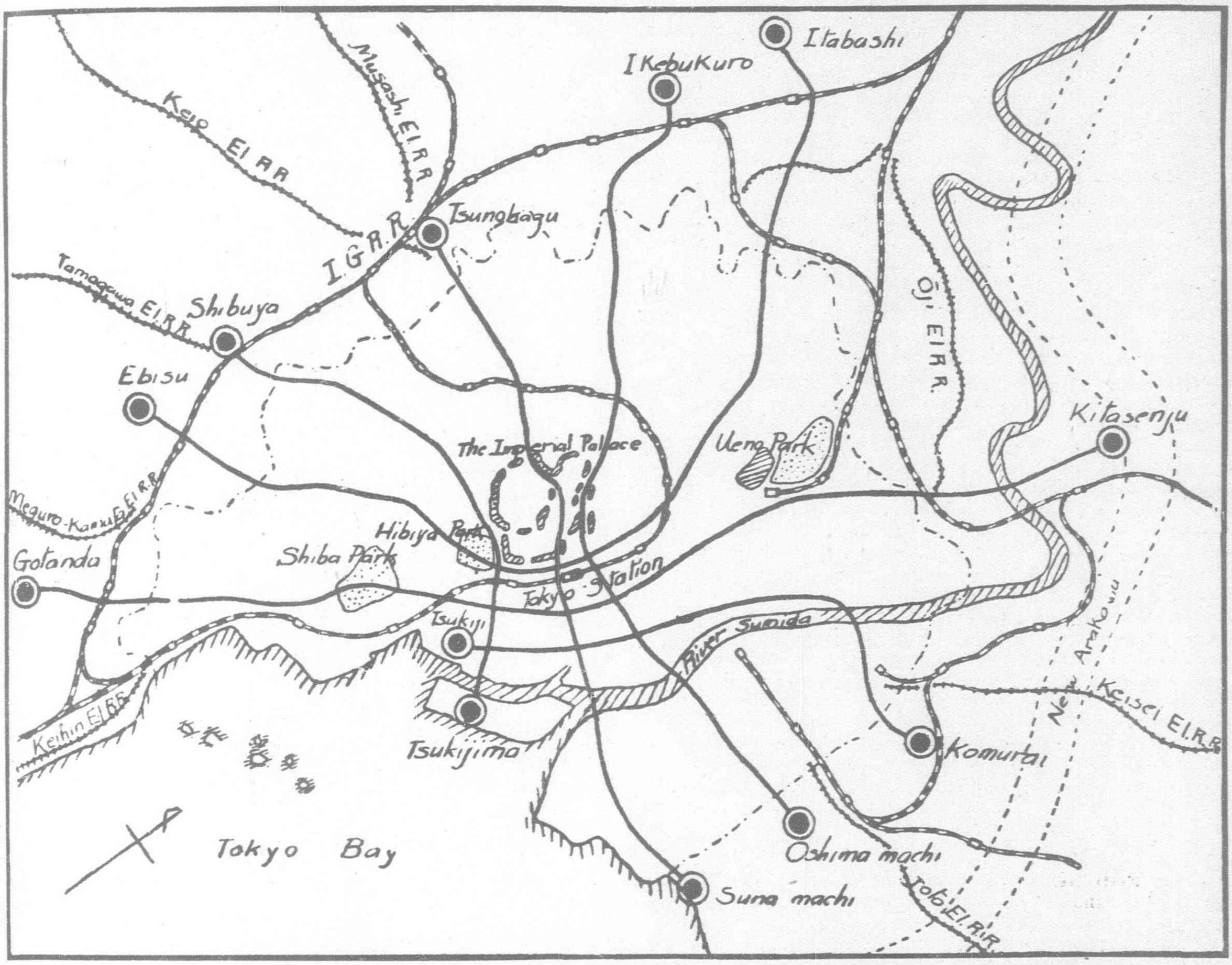
2. From the crushing of the copra to the loading of the finished oil into the trans-Pacific ships, no part of the product comes in contact with human hands.

3. In the process of manufacture the copra is subjected to germ-killing heat, from 212 to 240 degrees, Fahr. for, at least, 30 minutes, thus completely sterilizing the product.

4. For eatable purposes, or in the manufacture of margarines, coconut butter, lard substitutes, etc., in the United States, coconut oil has to be put through various refining processes. It is deoderized by forcing finely divided steam, through it, or by the use of hydrogen. Filtration through charcoal or Fuller's earth is resorted to, and in some cases a bleaching agent is also used. By means of these various processes, a white, bland, odorless and germless oil is produced, which is available for several uses of edible oil.

5. As for diseases in the Philippines, those that are contagious are adequately quarantined and the utmost possible protection is afforded the public against their spread. Through strict vigilance on the part of the government, the danger from infection from human sources in the Philippines has been reduced to minimum. In fact it cannot be any greater than it is in the United States.

As a matter of fact, the Philippine vegetable oil makers can defy the Pacific coast butter makers to produce a germless butter and can point with some satisfaction to the coconut butter substitute as being 100 per cent. pure and absolutely free from germs. But meanwhile the Chinese egg is having a rest and perhaps after a while, the butter makers' agitation also will die down and some other oriental product will have to bear the brunt of similar agitation on the part of those who, despite all tariffs and governmental protection, cannot stand the economic gaff.



The above drawing shows the six distinct subway lines (in solid black lines) that will form a network under the city. Notice that two of the lines go under the outer moats of the Imperial Palace. The round-the-city electric line is shown by black and white lines

Tokyo to Have Subways

FIRST formal steps have been taken to rebuild Tokyo along modern lines and the municipal council has approved the rough plans for 50 miles of subways for the city, according to the *Japan Advertiser*. The plans were presented by Mr. K. Nagao, chief of the electrical bureau of the council, at a meeting of the council in the Tokyo industrial club.

Engineers under the direction of Mr. Soyama have been working on the technical phases of the proposed subway system for two years, while the city has been contemplating such a system for an equal length of time. The rough draft presented and approved last night represents the results of these labors, which are now on the eve of fruition.

Wait Only for Contracts

The department of home affairs must accept the plans before actual work of construction begins. Contracts for financing and construction also will be formally signed at that time, probably with a foreign company which has long been on the field co-operating with and advising the city. The signing of contracts will be but a matter of form.

Plans of the electric bureau call for the construction of six distinct subway lines across the city, the 12 terminals being at or near the city limits. It is estimated that the subways, which will be double tracked, will cost Y.4,000,000 a mile, or a total expenditure of approximately Y.200,000,000. The six lines will be as follows :

Gotanda to Senju, 11.6 miles.
Ebisu to Itabashi, 11.2 miles.
Shibuya to Tsukijima, 5.5 miles.
Tsunohazu to Sunamachi, 7.6 miles.
Ikebukuro to Oshima, 8.3 miles.
Tsukiji to Komurai, 5.6 miles.

The double track system will be of the most modern type and will include first class equipment and rolling stock. An automatic signal and stopping system will allow the operation of high-speed trains at intervals as short as 45 seconds with perfect safety. The trains will be all-steel and the stations will be placed eight-tenths of a mile apart. Other details of the system will be worked out later when the plan as a whole receives the support of the 0overnment.

Ten Years for Building

It is contemplated to build the entire system during a 10-year period, and to begin work as soon as necessary steps have been taken. The city realizes that quick action is necessary, not only

in order to take care of the normal increase in traffic on the already overtaxed capacity of the surface lines, but also to absorb the increase in traffic that will result by the concentration of business into well defined central districts, where the new building regulations will require the construction of fireproof buildings too expensive for general use as combined residences and business quarters.

According to the electric bureau the loss incurred by the subway system during the first 10 years of operation will total approximately Y.15,000,000 or about Y.1,500,000 a year. This sum is counting the interest on loans and actual overhead expenses of operation. Beginning with the eleventh year the system is expected to start paying dividends. During the first 10 years the deficit will be made up from the receipts from the surface lines. Beginning with the eleventh year the subway will start paying back its debt to the surface lines, making its last payment on the 23rd year.

Engineering Not Difficult

The construction of a system of subways in Tokyo offers no new or unusual engineering problem, according to Mr. Soyama, and its cost, if built in connection with the other construction work necessary, will be comparatively small. Engineers, both Japanese and foreign, believe that a subway system is more practical and more safe than an elevated system. There is practically no danger from earthquakes as past experience indicates. Tunnels were injured by the earthquake last September only in such cases where the tunnelling was through a hillside, when the earth filled up the openings. In a subway there are no weak spots, the whole system being on one level below the surface.

The city officials realize that a subway system is absolutely necessary, not only as a phase of reconstruction, but also as a method of keeping pace with the changing form of Tokyo. The nation's capital is slowly developing from a conglomerate mass of little villages into a well organized city with a centralized business section. This movement will be hastened when the city announces its building laws and restrictions, which will demand the erection of fireproof business edifices. In this manner the old type of half residence, half business house will disappear in favor of modern buildings for business only. Not many years hence people will "come to town" to work, and "go out home" after the day's work is done instead of merely climbing the stairs from store room to living quarters.

Will Relieve Tram Lines

The present tramway system has reached its limit of capacity and the mere addition of more cars actually decreases this capacity by slowing down the speed of each car. The rush hour jam at main intersections in Tokyo now is much worse than in any other city in the world, according to the electric bureau experts.

The surface tramways have grown from a total track mileage of 123 miles in 1911 to 184 miles in 1924, while the number of passengers has increased from approximately 140,000,000 in 1911 to about 500,000,000 in 1923, an increase of approximately 250 per cent. During this period the yearly income from fares per capita inhabitant of Tokyo has grown from Y.3.49 to Y.6.62, or nearly 100 per cent.

The proposed system must not be confused with another system which has been under contemplation by a private company for several months. Though this company is still in existence the earthquake last September discouraged the organization and nothing definite has been done recently.

Millions for Advertising Teas

Notes on the Tea Industry of Asia

PROHIBITION in America has created a thirst for tea. In the last few years the annual consumption has increased about 18 per cent. and it is now a little under a pound per capita. The annual consumption in England is seven pounds, in Russia two and a half pounds, in Canada five pounds and in Australia about nine pounds. During the fiscal year 1923, roughly 955,000,000 pounds of tea were imported into the United States and if this was doubled or brought up to the consumption in Canada or Australia, the tea industry of Asia would face a long period of prosperity. Tea growers are awake to the possibilities and are going after that prospective American business in the only way to succeed.

Foremost in this movement is the Indian tea growers' association which has voluntarily assessed its members $200,000 a year to carry on a five-year advertising campaign in the United States. The Indian government, it is claimed, is also aiding its tea interests. This great campaign for India tea is being conducted along systematic lines by Sir Charles F. Higham. No efforts will be spared to teach the public the advantages of drinking India tea and its superiority over all other kinds of drinks. The campaign is to be an open, direct effort to induce the American people to drink India tea without disparagement of coffee, cocoa or other beverages.

Following the lead of their Indian competitors the Japan tea manufacturers' association has also voted a small appropriation of Y.$10,000 gold for American advertising and has asked the government for an advertising subsidy of Y.500,000. This seems a ridiculously small amount in comparison with the fund raised by the India growers, yet it is doubtful whether or not the Japanese government at this juncture will be able to assist its tea industry to this extent.

The China Tea Situation

Tea merchants in China are also trying to develop the American market and the question of standardizing tea products, the elimination of milddle men and advisability of launching an advertising campaign are receiving attention. It is hardly to be expected, however, that the conservatism of the Chinese tea guilds will rise to the height of appropriating any large sum for foreign advertising and it is equally out of the question at this time for them to expect any financial assistance from their government, aside from the present exemption of China tea from the usual export duty for a period which was recently extended until the end of 1925. The future of the China tea trade faced as it is with the strenuous competition of India, Japan and Java, all willing to spend large sums for extending the use of their particular brands of teas, is not particularly encouraging. China was once the world's principal source for tea, but in recent years has been steadily losing ground as an exporter.

Before the war China exported 190,000,000 pounds of tea to Russia, but last year, only 61,000,000 pounds. From first position, China has sunk to fourth in the international market as a tea producer. Prior to 1914 Russia took about two-thirds of China's exports of tea, and this consumption was maintained until 1918. In the following year Russia drew upon China only to the extent of a fifth of her pre-war average. The decline then set in rapidly, the figures each year showing a steady drop. Although the loss of Russian trade was compensated to a small extent by the American market, still the situation is far from satisfactory. The tea guilds have obtained the support of the central government and secured concessions in interior taxation and also exemption from export duty. The Chinese government sent a tea commission to India and Ceylon and as a result a tea industrial training school has been established at Nanking, where the sons of planters from all the provinces of China are sent to learn up-to-date methods of cultivation. In 1915 tea experimental stations were established and arrangements made for granting subsidies to deserving tea planters. The first experiment station was established in the heart of the tea-producing district of Keemun, in Anhwei province.

Unfortunately, owing to constant internal disorder, the central government has not been able to continue the good work and pending the establishment of a government that will encourage the development of China's resources there is little hope that China tea

will regain its once proud position in international trade. In spite, however, of these many handicaps, the tea trade during 1923 showed large increases in exports, almost every market taking larger quantities as compared with the preceding year, the only exception being the United States which imported 17 per cent. less for 1922-23 than during the previous year. The trade at Foochow increased over a hundred per cent. in spite of the disturbed conditions that existed in that district during the season. The total exports were 6,874,432 pounds in 1922-23, compared with 3,231,735 pounds in 1921-22 and 2,221,738 pounds in 1920-21. The following table shows the destination of exports from Foochow for 1922-23 as compared with 1921-22 :—

Destination	1921-22 *Pounds*	1922-23 *Pounds*
Europe	2,417,789	5,171,725
South America	82,375	52,181
Australia and New Zealand	218,752	687,797
United States and Philippines	230,204	447,379
South Africa	12,995	16,960
Coast southward	20,051	33,480
Coast northward	50,430	46,860
Other countries	199,139	418,030
Total	3,231,735	6,874,432

The 1923-24 season, which began June 1, 1923, has been the best since pre-war times.

The new campaign on the part of the India and Japan tea growers to increase the demand for their teas in the United States must have a still further depressing effect on the China industry and only by bettering methods of growing and manufacture and employing the same advertising tactics can China hope to regain even a part of her lost position.

Government Aid in Formosa

In Formosa, the Japanese government is applying to the tea industry a reorganization along modern lines of standardization and inspection. It is recognized that the tea industry of Formosa is far behind compared with such tea-producing countries as India, Ceylon and Java, where tea is produced under the " Estate system."

The tea-producing system in Formosa is very complicated, and as there are too many middlemen between producers and exporters the cost of tea is doubled or trebled by the time it reaches exporters, and quality degenerates through dishonest practices on the part of middlemen, resulting in unsuccessful competition and decline of reputation in foreign markets.

The Formosan government general has appropriated a subsidy for the improvements in production. The growers have been persuaded to organize, machinery, and other necessary equipment have been loaned, seedlings given gratis and a subsidy granted for purchase of fertilizer.

The Formosan government general has also planned improvements in marketing methods, and assisted in bringing the producers into direct touch with the exporters and packers in order to do away with middlemen.

In conformity with the official plan the plantation owners have combined in establishing a joint sales market in Taihoku, where all their output is sold hoping to realize the desired improvements in marketing methods. The rules of the joint sales market are as follows :

Art. 1.—The Joint Sales Market shall have a legal status of Kumiai (association of Guild), and shall engage in consignment sales and refining of tea produced by its members.

Consignment from persons other than its members may also be accepted according to circumstances.

Art. 2.—Those who are eligible to the membership of the market shall be corporations, guilds or partnerships established under the encouragement plan of the Government General.

Art. 3.—The title shall be " Taiwan Cha Kyodo Hambaisho " (Formosan Tea Joint Sales Market).

Art. 4.—The market shall be located in the city of Taihoku, and branch offices may be established according to local needs.

The Formosan Tea Inspection Regulations have been enacted by Government General Order No. 50, dated June 3, 1923. The tea under this regulation includes Oolong tea and Pouchong tea manufactured in Formosa. Tea traders under this regulation include persons engaging, for profit, in the manufacture, sale or purchase or exportation of tea to Japan or foreign counties.

With the adoption of this law as a basis for regulating sales and guaranteeing quality through government inspection further steps have been taken to save Japan's tea market from the competition of the better organized India industry. The Japan Tea Manufacturers Association as pointed out, has drafted a program to be put into effect with all possible speed, which includes an intensive propaganda campaign in America in favor of green tea. The Japanese tea growers believe that the Indian government is behind the huge advertising campaign in America and contend they cannot compete with this formidable competition without substantial financial aid from their own government and have asked for Yen 500,000, or one quarter the amount appropriated by the India tea interests. The Japanese association has also decided to appoint a new commission to study how to maintain or extend the overseas market for their products. The new commission is composed of 15 representative manufacturers and is headed by the president of the association. Three on the commission are authorized to supervise the advertisement and propaganda campaigns overseas.

The association will also maintain the reputation of Japan tea abroad by preventing the exportation of inferior tea and introducing innovations in the method of manufacture. Seven representative manufacturers are to form a commission for the conduct of the work.

* * *

Tea Cultivation

All tea comes from the same kind of plant, the name varying according to the country in which it is produced. Fundamentally it is the same everywhere, showing only such differences as are traceable to the climate, the soil and the method of manufacture.

The tea producing countries of the world to-day are India, Ceylon, China, Japan, Formosa and Java, Sumatra is now beginning to yield some tea, but the quantities are negligible as yet.

Tea that is fermented is known as " black ; " unfermented tea is commonly called " green." There are also varying grades of fermentation. Ceylon, India and Java, for example, produce very largely fermented or black tea ; Japan produces only unfermented tea ; China, both black and green, and Formosa, semi-fermented tea.

In the case of fermented teas, the natural sap is permitted to remain in the leaf for a certain length of time after it is picked. The leaves are prepared on withering trays for this purpose. This moisture is of such a nature that it works a chemical change in the leaf until the organic nature of the leaf is actually changed into an entirely new substance.

Just Like Hops

It is exactly the same thing which takes place in the handling of hops for the manufacture of beer. You will easily realize from this that the same tea plant can produce either fermented or unfermented tea, otherwise known as black and green tea—the difference being in the method of handling the leaf.

In making unfermented or green tea, the leaf is carried at once from the tea field to a room where heat can be applied to it (which is done in very simple fashion by the farmers of Japan, China and Formosa) ; the pores of the leaf are closed by the heat, this prevents the tea from fermenting and holds the elements produced by the soil. In comparison with wines, the green teas may be said to correspond to the dry champagnes, and Rhine wines, while the black teas remind us of the Burgundies and clarets, being of a thicker consistency.

In making fermented or black tea (which comes largely from Ceylon, India and Java), the leaf is permitted to ferment and after this process has been continued for a given period of time, the leaf is then fired so as to hold it in that state or condition—the fermentation being stopped by the firing.

Also Semi-fermented

In Formosa and the Fukien province of China, where Foochow teas are produced, the leaf is semi-fermented, that is, the process of exposure to the air before firing is not carried as far as in the case of fully fermented or black tea.

The methods that have been described of curing tea produce in the infusion, different ingredients and in the liquor, different colors. The consuming trade sometimes think they are getting very thin tea when they purchase the unfermented or green sorts, whereas

in reality they are getting a different combination of ingredients. A cup of tea drawn from the fermented or black leaf would lead the average consumer to think that the infusion was much stronger than that from the unfermented or green leaf, while in fact the thin looking cup of tea may have in it elements that are more powerful than those in the darker looking cup of tea.

Tea Thrives in Mountains

The places which produce the finest tea are always found among the grandest mountains. The tea plant loves the well drained side of a hill stream.

Tea requires a good, sound soil, a light loam, well mixed with sand and overlooking a winding mountain, vegetable matter, moderately moist, and yet not stagnant or sour. Tea fields are very much the same the world over, except that the spots producing the finest varieties, like the spots growing the finest wine grapes are extremely limited.

In China, Japan and Formosa, the culvation of tea cannot be carried on to such a state of perfection as in Ceylon and India, partly because the soil is not as rich, and partly because the farming is in a cruder state in the first mentioned countries.

In the case of the tea fields of Ceylon there is a tremendous acreage, almost all of the land being available for cultivation. The handling of the estates is in the hands of intelligent agriculturists who have in their employ, chemists who are continually analyzing the soil and bringing the productive qualities of the land to the highest point. The estates of Ceylon and India, the home of orange pekoe tea, are managed by Englishmen, who naturally can bring to bear the most scientific methods—methods practically unknown in other countries. It may be said for Japan, however, that they have established a scientific shcool for the handling of the tea plant, and that they are studying to improve the industry.

Climate is Important Too

Climatic conditions enter very largely into the quality of tea produced in a year's time. In Japan and China the amount of moisture in the atmosphere is negligible, except in the very rainy seasons when they have a large precipitation. In the Island of Formosa there is more moisture, but they also have a climatic condition which produces cold weather so that the vegetations dies. Orange pekoe tea, grown in India, is produced under favorable conditions, because there is moisture in the atmosphere that helps dampen the ground continually and keeps the plants growing, so that many more pickings are possible in India during the season than are possible in Formosa. The seasons in China and Japan are the shortest of any. In the case of Ceylon and Java, however, there is continual precipitation. If it is not in the form of rain, it is produced by the heavy dews, so that vegetation is continually growing and teas can be plucked the year around. A field of Ceylon, India orange pekoe tea is a far more valuable piece of property than a similar one in any other country because the picking proceeds throughout the year.

Gathering and Curing Leaf

Harvesting the leaf is practically the same in all countries. The firing process, also, in its essentials, is practically the same, as it simply means the application of a certain degree of heat to the leaf. The receptacle in which the tea is handled may be a simple wicker basket, with a platform separating it from the charcoal fire made underneath it, or it may be the pans of Japan, or the biggest machinery used in the orange pekoe fields of Ceylon, India.

Separation of Tea

The next process after the withering and firing of the leaf is the separation into grades, such as come to market. This is done either by hand, or by machinery as in Ceylon, India, where a superior grade of tea, orange pekoe, is grown. China has some crude hand machinery which is used in eliminating dust and stalks from the teas, but in the case of Japan, the sifting and separating of tea is one of the most extensive of all methods, for the leaves here are separated into ten or twelve different kinds, from which the various grades are made up. One sieve eliminates dust, siftings and stems and the nibs of the leaf. By sifting, the leaves are divided into coarse, fine and medium. Then the leaves are taken and divided into various degrees of coarseness or fineness, and after the entire batch is sifted out, certain sizes of the leaf are put back together to form the grades that are offered on the market.

The packing of teas, whether into small packages or into regular chests, is really the same the world over. There are facilities in all the different countries for packing teas, under private brands, in almost any size and quantity.

* * *

Honorable Tea ("O Cha")

Japanese Methods

Japanese tea is classified according to quality into three grades: (1) Hikicha, or powdered tea, which is the highest quality and is used only on ceremonial occasions. (2) Gyokuro and Sencha, which are both called green tea by exporters; Gyokuro is of better quality than Sencha, the latter being drunk by the bulk of the people. (3) Bancha, which is the lowest quality and consists of old leaves mixed with withered stalks and chopped twigs. The green teas—Gyokuro and Sencha—for export purposes are generally divided into six kinds: (1) Pan fired tea; (2) basket fired tea; (3) nibs; (4) fannings; (5) dust siftings; and (6) brick. The first three sorts are the best and derive their names from the method of firing used, the last three kinds being the poorest qualities.

Tea is grown in all parts of Japan with the exception of Hokkaido. According to the latest figures of the department of agriculture, the total area of the tea plantations is 50,000 *cho*, *i.e.*, 122,500 acres (1 *cho*—2.45 acres), and the annual production amounts roughly to 83,000,000-lb. The number of manufacturers exceeds one million, so it is obvious that tea growing in Japan is still a household industry.

The Japanese tea grower prefers to plant his bushes on the lower slopes of hills, although, providing the drainage is satisfactory, successful plantations can be laid out on the level plains. The bushes are usually allowed to reach a height of about 3-ft., but in the famous Uji garden they are frequently 6-ft. high. A peculiarity of the Uji district is the cultivation of tea plants under artificial shade, provided by straw mats, which tends to produce a better quality leaf of a darker green colour. The leaf from these shrubs, sheltered in this way from the sun, is highly esteemed by the Japanese and grown exclusively for their consumption. There are as a rule four crops in the year, the first crop, which is usually picked in the latter part of April, producing about 50 per cent. of the annual yield. The picking of the second crop begins about 40 days after the first, and contributes 30 per cent. of the total. The remaining 20 per cent. is obtained from the third and fourth crops, the leaves of which are of inferior quality. Throughout the country tea-picking is carried out by women, practically without exception.

The Japanese believe that it is impossible to produce the correct delicate aroma by mechanical treatment of the leaves, and so in the production of the better class of green teas no machinery is used, the whole process being carried out by the old-fashioned hand method. In the case of exported tea, however, machinery has taken the place of hand labour, or machinery and hand labour are employed in combination.

Preparing the Leaves

The preparation of the leaves begins as quickly as possible after picking, and in the case of green tea, which forms the bulk of the Japanese tea crop, the first process is steaming. The leaves are steamed for a few moments only, so that they retain their green colour and acquire the peculiar aroma at the same time. The steamed leaves are then dried and poured into firing trays lined with paper, where they are turned over repeatedly by the workmen. As the firing progresses, the fresh green colour of the leaves gradually changes to an olive brown, and the fragrant odour of the tea becomes perceptible. The mass gradually shrinks in size as the moisture evaporates, and when finally pronounced to be dry it is seen that each leaf is separately twisted and rolled. The whole operation of firing lasts about three hours, but where machinery is employed the same process can be completed within 1½ hours.

Japanese tea was not introduced into foreign countries until 1868, in which year some 13,000,000-lb. were exported to the United Kingdom and the United States. Since then, the export trade of Japanese tea to the United States has greatly increased, and the leaf holds a very strong position there. Owing to the overwhelming competition of the Indian product, the green tea made little impression in the United Kingdom, and has found no favour there. Japan now exports yearly 44,500,000-lb. of tea, 85 per cent. of which

consists of the pan-fired and basket-fired varieties. The largest customer is, as already mentioned, the United States, China and Canada ranking next.

Besides green tea, Japan produces Oolong tea, which is exclusively produced in Taiwan. The area of this island's tea plantations is stated to reach 38,000 *cho* (93,100 acres), the average yield being 30,000,000-lb. Two-thirds of the whole crop is absorbed by the United States. A small quantity is also exported to Europe, where it is used as blending tea. Home consumption is very small, as the majority of the Japanese people are accustomed to drinking green tea without sugar or milk, and Oolong tea cannot be drunk neat.

The High-Pressure Steam Convention of the Institute of German Engineers

Held in Berlin, January 18 and 19

MANY branches of the technical industries are highly interested in the question of raising the working pressure of steam boiler plants in order to save fuel. A clear proof of this is the number of persons present at the opening of this meeting, at 3 o'clock on the afternoon of January 18, in the Beethoven Hall of the Philharmonic Society of Berlin. Approximately 2,000 engineers from all parts of Germany and from many foreign countries attended, many of whom had to stand in the crowded hall.

The president of the association of German engineers, Professor Dr. G. Klingenberg, opened the first day's meeting by a speech, in which he briefly reviewed the lectures which were to be held during the convention and would deal with the progress made in the matter under discussion. By utilizing the most recent improvements, we are in a position to raise the economy of steam plants practically to the same level as that of Diesel engines, and to reduce the coal consumption of power plants to about one-half of the present figures. These improvements are not restricted to steam technics, but also affect the technique of boiler furnaces. In steam plants it is essential not only to raise the working pressure, but also to improve the design of the st am turbines, to employ intermediate superheating, to preheat the feed water with steam tapped from the turbine, in order to create conditions which will render it possible economically to utilize such high-pressure steam.

The technique of furnaces has made an important stride forward in this direction by using pulverized coal with these furnaces inferior direction by using pulverized coal. With these furnaces inferior fuel can be burned as economically as best quality coal, a problem of paramount importance under present conditions. Another item of interest for power stations is that the pulverized coal furnaces avoid all fuel losses when shutting down and restarting the boilers.

Director Dr. Münzinger of Berlin then discussed the technical and economical principles of the production and utilization of high-pressure steam. His lecture chiefly analysed the question as to under what conditions savings can be made in the total running expenses of a works by increasing the steam pressure, bearing in mind the reduced coal consumption on the one hand, and the increased expenses for erection and depreciation of a new equipment on the other hand, questions of vital importance to every owner of a power plant. The result of his investigations proves that between 15 and 100 atmospheres (213 and 1,420-lbs. per sq. in.) pressure this question must be treated to meet the individual requirements of the power station.

For a station, the steam of which is exclusively used to produce power, the economically most favorable result, *i.e.*, 3 to 7 per cent., is obtained when the pressure is raised to approximately 35 to 50 atmospheres (500 to 710-lbs. per sq. in.). Beyond this pressure, the costs of the boiler drums exceed the possible saving. The lecturer, threefore, advocates boiler designs whose water and steam chambers aer limited as far as is compatible with reliability and the production of dry steam. If, on the other hand, a power plant supplies large quantities of steam against high back pressure for manufacturing purposes, as is the case for instance in the chemical industry, a saving of 10 to 20 per cent. on the running expenses can be made, even when the boiler pressure has been increased to 100 atmospheres (1,420-lbs. per sq. in.)

This shows that high-pressure service will for the time being be most advantageously applied to combined heating and power plants operating with back pressure; however, also in pure power stations a saving of approximately 25 per cent. of the thermal value of the fuel consumed can be made with a slight increase of the pressure, if intermediate superheating and gradual preheating of the feed water by means of steam tapped from the turbine is adopted. It is most probable that the power plants of the future will be designed along these lines, though steam accumulators in the low-pressure circuit, coal dust furnaces and air preheaters may be added.

The next lectures given by Professor Dr. Goerens of Essen and Director Loch of Düsseldorf dealt with the question of materials and the manufacture of steam boilers for high pressures. Dr. Goerens chiefly pointed out the advantages accruing from the employment of nickel-steel, the greater mechanical strength of this material permitting the boiler drums to be made of thinner plates, which are more easily machined. Besides this, the nickel steels with 3 and 5 per cent. of nickel, are preferable to the mild steel prescribed by the laws, because when the boiler is subjected to higher temperatures, they do not show such a reduction of the mechanical strength or such increased brittleness as mild steel does. This enhances the safety of the boilers. Dr. Goerens recommends making high-pressure boiler drums of one single forged or rolled piece, which can be subjected to the necessary hydraulic tests, to ascertain if it has the requisite mechanical strength before delivery.

Mr. Loch illustrated his lecture with lantern slides showing the audience the complete manufacturing process of a modern boiler works. He also demonstrated how deterioration or damage of the materials is nowadays avoided by controlling the temperature when heating the plates, and the pressures when riveting the boilers. Two films, giving views of the boiler works of Borsig and Dürr, followed the lecture.

Second Day's Meeting

The second day's meeting was likewise opened by a short speech of the president. He suggested that the burden of work, which was about to devolve on the engineers and works before practically realizing high-pressure service, might be rendered more tolerable if the high-pressure steam convention would accept a pressure of 35 atmospheres (500-lbs. per sq. in). as a temporary limit, and, accordingly, would establish certain standard boiler sizes. Further details could then be discussed in the boiler committee, which has for some time past been appointed by the association of German engineers.

Dr. M. Guilleaume of Merseburg reported very interesting and important experience gained in steam boiler plants, based on tests made by the association of large boiler owners, founded in 1920, to promote the safety of large boiler plants. These tests prove that utmost care must be exercised when testing the boiler plates, so that the designer may be convinced that the plates in their entirety possess all the qualities which were ascertained during the tests, and, furthermore, that the machining of the plates until they are assembled in the finished boiler, especially too high a riveting pressure, can very materially affect the properties of the plates and render them unreliable. The observations made with special measuring devices of novel design to ascertain the alterations of shape to which the finished boiler is subjected owing to fluctuations of the temperature and pressure are of great value.

These alterations can never be entirely avoided in actual service owing to the fluctuations of the load, therefore it is essential to design the boilers so that they have sufficient elasticity and that no undue stresses arise in any part of the boilers. On the other hand one should also strive to eliminate such influences by keeping the load on the boilers and feed water supply as constant as possible. Very valuable observations have also been made concerning the circulation of the water in boilers. The results of these observations are of special interest now that it is contemplated to run boilers at very much higher pressures than were usual up to the present.

The last speaker, Professor Dr. E. Josse of Charlottenburg, lectured on the properties and utilization of high-pressure and super-pressure steam. He told his audience that when the working pressure is raised from 20 to 100 atmospheres (284 to 1,420-lbs. sq. in.), the most recent data concerning the properties of steam proved that theoretically the useful work available in 1 kilo (2.2-lbs.) of steam could be increased by 15 to 83 per cent. according to the back pressure obtaining. However, if this is to be applied to a steam engine or steam turbine, two points must be observed: First, that high-pressure steam becomes saturated much more quickly when

expanding, because, for reasons of safety, superheating may not be increased beyond a certain maximum temperature; Second, the-work to be produced by the steam in the high-pressure zone will be the greater, the higher the initial pressure is taken. The first point makes it compulsory to dry the steam repeatedly during the different stages of expansion up to back pressure, as otherwise the water contained in the steam would reduce the thermo-dynamical efficiency.

The second point is of special importance for steam turbines, the present design of which, contrary to that of reciprocating engines, is not suited to economically utilize the steam in the high-pressure zone. As a matter of fact, recent high-pressure steam technics have been the incentive to develop special types of turbines which economically utilize high-pressure steam and are the first practical results of modern high-pressure practice. A number of works are already busy building such turbines, and the very extensive tests made with a high-pressure turbine designed by the Erste Brünner Maschinenfabriks-Aktiengesellschaft, showed up an efficiency of over 80 per cent, a figure, which up till now, and been deemed impossible for steam turbines.

The lectures were followed by a debate, lasting several hours. Space does not permit giving a detailed account of the interesting topics which were discussed during the debate. To carry them, a special number, entitled "High-Pressure Steam," containing the lectures, the debate and several other articles dealing with the same subject, will shortly be published by the association of German engineers.

The convention has undoubtedly been a great success, and it is, therefore, not astonishing to hear that several members have called for a second debate on this very interesting and instructive topic. The closing words of the president, with which he asked the audience to honor the undaunted inventor Wilhelm Schmidt, the pioneer in the field of high-pressure steam, in whose spirit the meeting has been convened, wre hailed with hearty cheers.

Railway Development in Indo-China*

ALTHOUGH the French occupation goes back but a few decades and in spite of the fact that the first few years were troubled with various outbreaks of insubordination, railways have been established and have been in operation for some time now. A program of economic development of the peninsula by means of railroads has been prepared and is now being carried out so that the railways actually built should not be considered by themselves but as part of a whole.

The few original private companies have been bought up by the government so that, as in most neighboring countries, the railways are government property and under its direct administration. A few words regarding the carrying out of this program to its conclusion are not without interest. As regards the money required this is generally set aside in each year's budget for the work to be done during the year. Loans are sometimes resorted to in cases, for instance, when it is required to accelerate the building of any given line and so far these have been quite successful. Prospecting new routes is carried out by special commissions appointed for the work or by the public department. The track making, rail laying and the building of stations, depôts, etc., is entrusted to local contractors under government supervision. The supply of steel sleepers, steel bridges, locomotives and rolling stock is obtained by tender from any recognized engineering firms. Naturally enough French tenders have been getting all the orders but there is no reason why foreign firms should not tender also when any of the above-mentioned material is required. As a matter of fact it is understood that there are actually Japanese-built locomotives in use which were bought some years ago and it is evident that a country fairly close at hand like Japan with good shipping facilities can supply with a very low cost for freight.

To give an idea of the work still to be accomplished it is interesting to note that the present program of lines totals some 4,600 kilometres and that of this distance but one-half is in operation, including the line to Yunnanfu, so that there is still plenty to do. The lines in existence in Tonkin and in Cochin-China have not yet been linked together so that at present, for administrative purposes they are divided into the North Indo-China and South Indo-China railways.

The continuation of the work required by the program of railway development calls for feats of a very high technical level, as the geography of the country will show. Around Hanoi and Saigon are huge river deltas of soft alluvial plain requiring tremendous bridges with caissons sunk 30 or 40 metres deep to span the waterways. Along the sea border on the east the coast is continually cut by gaps and openings of various sizes through which rapid streams make their way to the ocean or in which are large low-lying expanses given over to salt making. Inland lies the fertile valley of the Mekong river with its tremendous volume of water flowing more or less parallel with the coast and between these two is the Annamitic range of mountains with an average height of 1,000 metres. As it will be understood from the above description railroad making is not simple work and takes time. As a corollory it will be seen that much money still has to be spent but it will be well spent and in years to come will repay an hundredfold.

When the railway system of French Indo-China is completed it will form a whole with various political, strategical and economic consequences. Roughly speaking, this system will contain six distinct lines with different objects in view. Taking the sea-lines from the north and working southwards they will be as follows: First the line from Hanoi to Yunnanfu the capital of the Chinese province of Yunnan. This line was built years ago (after the Russians had built the Manchuria railways and when each foreign nation was obtaining concessions in China for building railways), with the idea of draining the produce of Yunnan to a French port and increasing its wealth, and this was well accomplished if one considers the growth of Haiphong which is the port for Hanoi. If we remember right, it was intended to continue this railway to Szechuan province, perhaps the richest in China, but evidently some obstacles have arisen in the way of its carrying out. This line is 860 kilometres long, is a marvel of engineering achievement and is paying its way.

After this line is the local Tonkin railway about 17 kilometres in all radiating round Hanoi and towards the points on the Chinese frontier. This district is densely populated and the traffic quite intense. As a result the parts of this railway already in operation are bringing in good returns.

Connecting Hanoi to Saigon is the Trans-Indo-China railway not yet completed. It is 2,100 kilometres long of which three sections are already built; these are Hanoi-Vinh, Don-gha-Tourane and Nhatrang-Saigon totalling 1,200 kilometres. The first section is paying its way but the two others are showing a deficit yearly due to the scanty population of the districts connected, but it is expected that this state of affairs will cease as soon as the whole line is completed. This line is being pushed by the government as it also has a strategical importance.

A line being planned at right angles to the Trans-Indo-China railway is that between the east coast about Vinh to the Mekong river at Thakek, passing through Tanap. This line, 187 kilometres long, will be used as an outlet for the products of Laos province which is at present blocked in between the Mekong river and the Annamite Range and which has a tendency to look towards Siam for an outlet for its produce.

Another line is planned from Saigon to the Siamese frontier near Battambang, 645 kilometres in length, to connect up with the Siamese railway to Bangkok. When this line is completed and the Trans-Indo-China also, it will be possible to travel right through by rail from Penang to Hanoi and this will be a big step towards the making of a south Trans-Asiatic railway.

The last railroad down on the program is a local railway for Cochin-China connecting Saigon to the rich districts lying to the south-west now producing rice. This line is roughly 340 kilometres long of which 70 are already built from Saigon to Mytho. The traffic is mostly dependent on passengers but this portion of the line is quite prosperous. As already stated the completion of all these lines still requires time but there can be no doubt as to the ultimate prosperity to be derived for Indo-China from the development of its railway system.

* J. RUET, in *L'Information del Extreme Orient.*

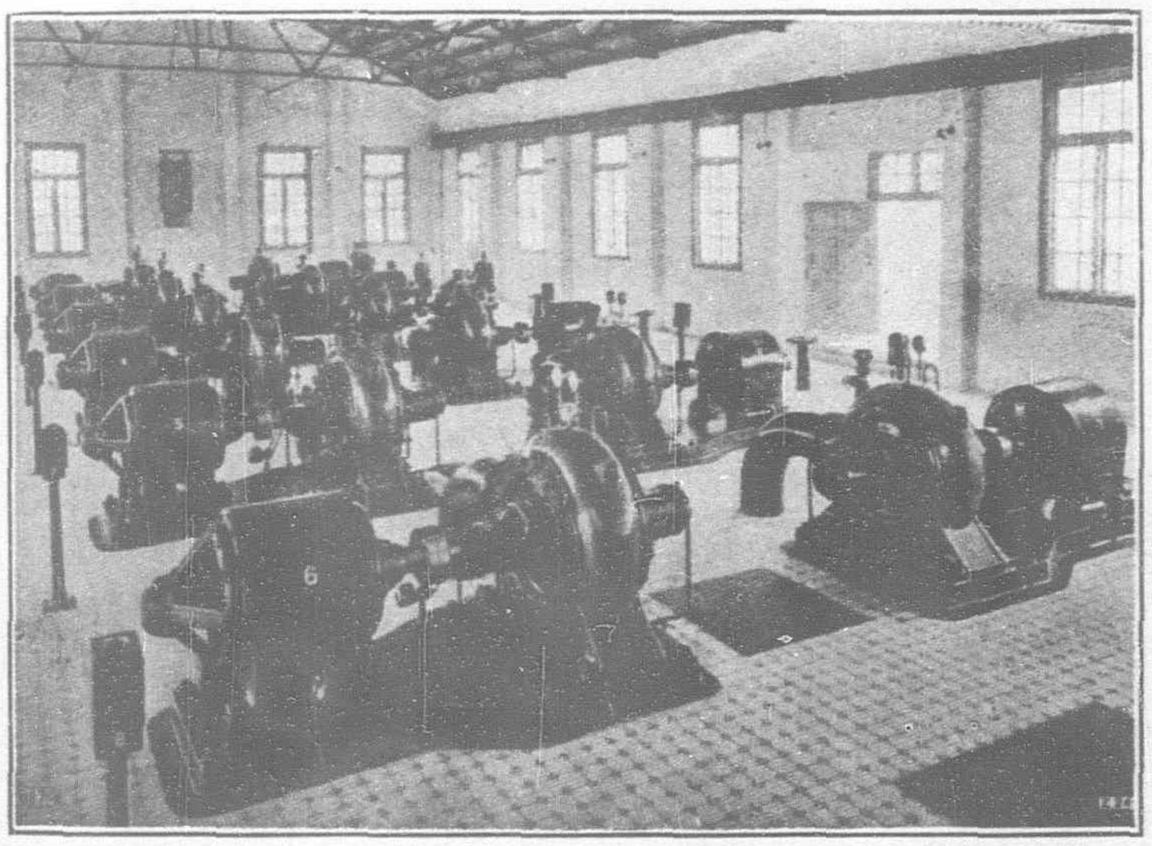
Osaka Waterworks

A Sulzer Installation in Japan

MANY towns and country districts in Japan possess waterworks equipped on modern lines, and one worthy of particular mention is the Kunishima Waterworks, of the municipality of Osaka. The original scheme was to provide pumping sets delivering 450—500 cub. ft. or 600—700 cub. ft. per min. against a manometric head of 200 ft., but after further consideration of all matters, it was finally decided to install sets delivering 600 cub. ft. per min. against a manometric head of 180-ft.

The following is an extract from the specification issued to the firms invited to tender for the work :—

"The pumping machines required are, in all, twelve in number, each machine consisting of a centrifugal pump direct coupled to a three-phase induction motor of high efficiency. Each pump should be capable of lifting filtered fresh water at a steady and continuous rate of at least 600 cubic ft. per min. against a total manometric head of 180-ft. The water level in the suction well is expected to fluctuate from 4-ft. to 14-ft. below the floor level. Every pump should be capable of sucking up water from the suction well, through the strainer, foot valve and suction piping, against any suction head within this range. If oil be used for lubrication of the stuffiing boxes or glands in the walls, or covers of the casing through which the shaft passes, some means should be provided for preventing it from entering the inside of the casing. The masses of the revolving parts should be perfectly balanced, so that there is no vibration or noise when the pump is running at any speed attained. The casing should be so designed and made, that the inside is easily accessible and the impeller and guide ring can easily be taken out whenever required. Every part of the pump should be designed and made with such strength and stiffness, that the machine can run continuously with safety, even when the load is 20 per cent. more than the normal."



Municipal pumping station, Osaka Waterworks (Japan). 12 Sulzer Centrifugal pumps delivering a total of 7,200 cubic feet per minute against a head of 180 feet.

The particulars given in the specification called for 12 Sulzer pumps, each delivering 600 cub. ft. per min. against a manometric head of 180-ft. and running at 1,170 revs. per min. to correspond to the periodicity of the three-phase supply which is 60 cycles.

The interior of the completed pumping station is shown herewith. The pumps are of the single-stage high-lift centrifugal type with guide rings and constructed to a special design.

The twelve pumps were submitted to specified tests, in batches of four, these tests being carried out at Winterthur before despatch. The testing arrangements conformed to the usual practice as laid down and approved for official tests.

The manometric head was ascertained by actual measurement of the suction head from the water level in the suction well to the middle of the delivery pressure gauge, and by measuring the pressure head by means of a control pressure gauge. The quantity of water delivered was measured by a Venturi meter and the head adjusted by throttling for which purpose a gate valve was employed. The pumps were belt-driven by a 500-h.p. three-phase motor, the characteristic curve for which was obtained by a mechanical brake and electrical measurements. The power absorbed by the shafting and belting was ascertained by uncoupling each pump. Table I shows the test results of the first four pumps running at 1,170 revs. per min.

All four pumps easily attained the guaranteed efficiency of 80 per cent. and in some cases exceeded it by 1 or 2 per cent. The quantity of water delivered by the pumps and the heads against which they could work also proved to be somewhat greater than what had been anticipated from the calculations and tests made with pumps already built on similar lines.

The official trials at Osaka after the pumps were installed, were carried out under the supervision of professors of the Osaka technical college appointed at the request of the Municipality.

All twelve pumps were tested on site and the results of some of these tests are given in table 2. When these results are compared with those obtained at Winterthur, it will be seen that they confirm that the efficiency of the pumps exceeds 80 per cent. *En.*

TABLE 1.

	Guaranteed	Tests					
Delivery, cub. ft. p. min.	600	594	755	596	600	615	716
Suction Head, ft. mano		10.5	10.5	10.2	10.2	10.2	10.5
Delivery Head, ft. mano		186.3	170.8	186.0	189.3	196.8	177.8
Total Head, ft.	180	196.8	181.3	196.2	199.5	207.0	188.3
Revs. per min.	1,170	1,178	1,162	1,160	1,168	1,167	1,165
H.P. at *motor shaft*		289	339	289	299	304	339
H.P. lost in shafting and belting ...		16	16	16	16	16	16
H.P. absorbed by pump	260	273	323	273	283	288	323
Theoret. H.P. of pump in water raised		225	264	225	230	245	259.5
Efficiency of the pump per cent. ...	80	82.5	81.7	82.5	81.3	80.6	80.3

TABLE 2.

	Guaranteed	Test No. 1	2	3	4	5	6	7	8	9
Load, approx. ...		1/2	3/4	7/8	4/4	9/8	4/4	5/4	4/4	0
Delivery, cub. ft. per min. ...	600	240.4	465.9	532.1	610.3	681.3	613.7	769.1	612	0
Delivery Head, ft. mano		192	192	188.7	185.5	177.6	185	163	177.5	172.5
Suction Head, ft. mano		7.9	7.9	8.1	8.4	8.9	9.1	9.6	14.8	14.7
Total Head, ft. mano	180	199.9	199.9	196.8	193.9	186.5	194.1	172.6	192.3	187.2
Revs. per min. ...	1,170	1,200	1,185	1,180	1,175	1,170	1,175	1,175	1,180	1,190
Motor input in k.w.		128	186	202	222	241.2	224.8	262.4	223.2	90
Net power in k.w. ...		67.9	131.7	148	167.3	179.6	168.4	187.6	165.4	
Combined efficiency per cent. ...	74.5	53.04	70. 79	73.27	75.34	74.32	74.9	71.5	74.1	

American Gold Concession Ratified

The union council of people's commissaries has ratified a concession agreement with an American syndicate headed by Mr. Jameson Wint for the working of the gold bearing areas along the river Semirtak in the Amur district, according to a Rosta report from Moscow. This is similar to the Smith concession ratified last November for gold-production along the river Charga. The concessionaire undertakes to erect on the area assigned to him sufficient dredges to work steadily for a period of 20 years. The gold-bearing areas are to be properly equipped by him not later than by July 15, 1925. He undertakes to work at least 2,572,500 cubic feet per season. In addition to paying rent for the area assigned to him, the concessionaire will also pay a certain percentage of the gross output of gold. The government is to have the prior right of buying the whole of the gold output.

The hire of labor, and all matters relating thereto, are to be strictly in accordance with the established Soviet labor laws and regulations. They are to be governed by collective agreements between the concessionaire and the trade unions. As a guarantee of the proper execution of the agreement, the concessionaire deposits property to the value of 35,000 gold roubles. All conflicts between the parties are to be submitted to the law courts of the Soviet union. The concession is granted for 26 years.

Mongolia—A Sorry Picture

By Dr. Jacques K. Maguite

MONGOLIA is one of the most interesting countries on the whole globe. Seven centuries ago the heart of a gigantic empire throbbed there. There stood peaceful cities and there the fates of nations and kingdoms were decided. There those chains were made which held in bonds for two-and-a-half centuries Russia and part of Central China. The sad consequences of that bondage may be felt even now. Those wide plains were inhabited by droves of horses, while 10,000 tents were scattered about these steppes and on the slopes of the mountains. At night countless fires lighted the plains and around these the terrible warriors of the great Chingis Khan clustered. The creaking of wagons, the lowing of herds, the neighing of steeds and raint shouts of the people were the noise which filled the air. All there was full of life and movement, everything was boiling over with energy and impertinent bravery. But now ? . . .

Thousands of miles you may travel and no signs of life will meet your searching gaze. No tents, no droves of horses, no herds, not even some lonely rider will pass you. The sand brought there by the winds during thousands of years, have covered and separated this rich land from all cultured nations and even from its nearest neighbor, China.

This picture is a symbol of the Mongolia of to-day ; endless deserted steppes, utter hopelessness, dull despair and everywhere overgrown monuments of the past.

A mountain plateau forming the farthest outskirt of central Asia lying between 42° and 52° of latitude and 88°-116° longtitude. Surrounded by a chain of mountains in the east slopes down to the desert of Gobi. Thus, as a whole, Mongolia presents a country unusually complete in itself and separated by nature from the surrounding world. Out of the five-and-a-half thousand miles of Mongolia's boundary line over half is contiguous with Russia and the rest with China. Thus Mongolia is jammed in between two great empires, a fact which has greatly influenced the whole of its history. The maximum distance of Mongolia from north to south is about 1,000 miles and from east to west 2,500 miles, thus, the whole area according to the latest information, is roughly estimated at 1,500,000 square miles or greater than that of Germany, France and Great Britain.

Mongolia is composed of mountain ridges, comparatively narrow valleys and deep gorges, through which flow rivers and in which lakes are embedded. Besides these, there are the sands and steppes. The Mongolian sands are the continuation of the centro-Asiatic desert Gobi, which are scattered in large areas over all of its south-western part. The eastern part however is covered chiefly with steppe-like plains, remarkable for their scarcity of water, some times for miles you may not meet either river or stream, not even the smallest lake is apparent, desert stretching to the horizon. The Mongolian soil is chiefly saline, sands, rocky loam or in a few rare rigions, black fertile mould.

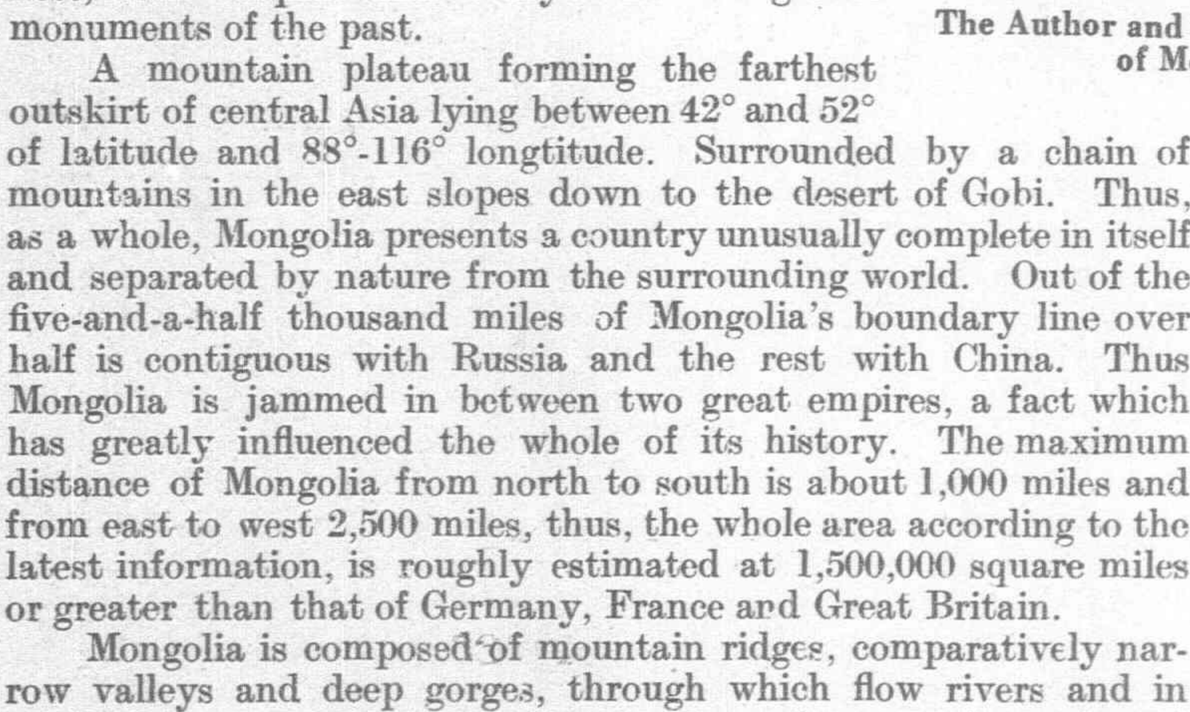
The rivers and lakes are the chief irrigation system of Mongolia and chief among these are Keroulen, 750 miles in length, and the Selinga 540 miles in length. Both these rivers empty into the ocean. Some of the smaller rivers are : Tess 520 miles, Kobdo 360 miles and the Dzanhin 490 miles. The most important lakes are: Kosogol, Ubsa, Kirgis, Nor and Hara and Usu. Mongolian rivers are comparatively short and shallow, the lakes are small and are located mostly in the western part. This fact is very important and has no doubt had a great influence on the history of its people.

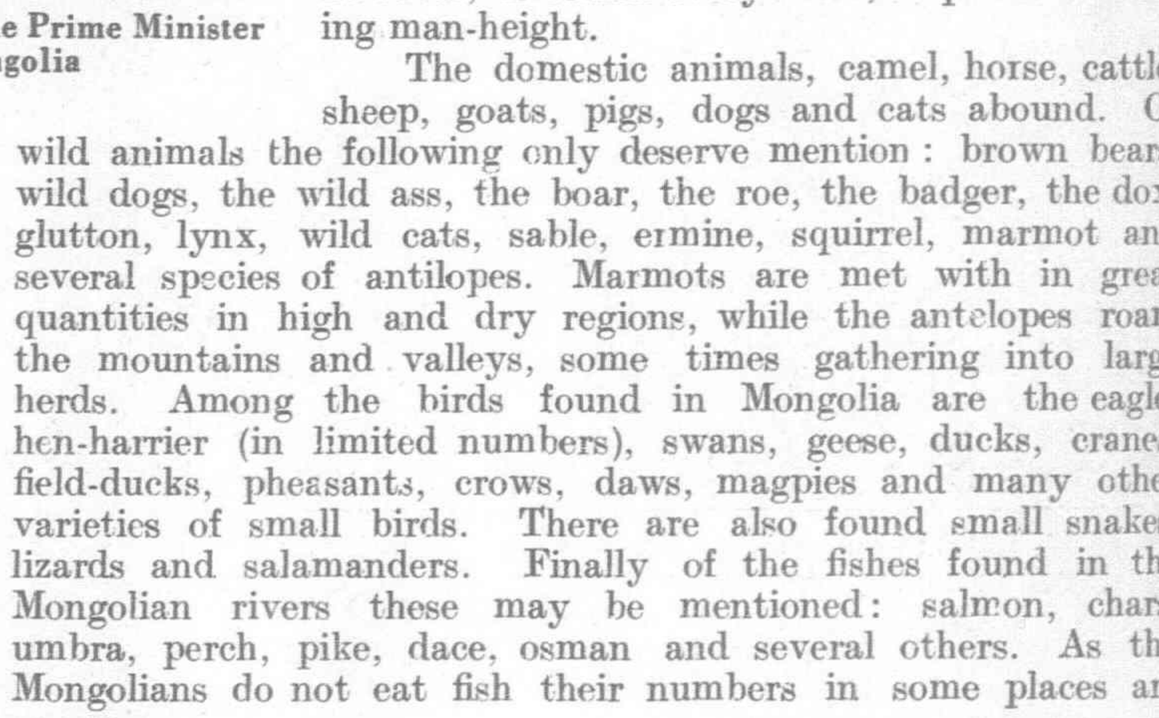
The Author and the Prime Minister of Mongolia

The great altitude of the territory, its insufficient irrigation, its distance from the sea and surrounded on all sides by high mountain ranges which intercept the moisture brought from the oceans, are the factors which determine Mongolia's climate.

Forests are few and we look in vain for something resembling the Taiga of Siberia. Grass, however, is found everywhere, in places exceeding man-height.

The domestic animals, camel, horse, cattle, sheep, goats, pigs, dogs and cats abound. Of wild animals the following only deserve mention : brown bears, wild dogs, the wild ass, the boar, the roe, the badger, the dox, glutton, lynx, wild cats, sable, ermine, squirrel, marmot and several species of antilopes. Marmots are met with in great quantities in high and dry regions, while the antelopes roam the mountains and valleys, some times gathering into large herds. Among the birds found in Mongolia are the eagle, hen-harrier (in limited numbers), swans, geese, ducks, cranes, field-ducks, pheasants, crows, daws, magpies and many other varieties of small birds. There are also found small snakes, lizards and salamanders. Finally of the fishes found in the Mongolian rivers these may be mentioned: salmon, chars, umbra, perch, pike, dace, osman and several others. As the Mongolians do not eat fish their numbers in some places are enormous.





THE WEALTH OF MONGOLIA

Mongol catching a pony with a noose on end of a pole

Sheep grazing on the outskirts of Kobdo

The many attempts to estimate the population of Mongolia are very unsatisfactory. According to the latest estimate the population is follows :

1.	Province of Han-Czozen	132,700
2.	Province of Han-Toutetou ..	145,450
3.	Province of Han-Sain-Noin ..	171,900
4.	Province of Han-Dzaktou.. ..	85,200
5.	Buddhist monks in the 4 provinces	72,350
6.	Lands of Bodgo-Gegen	17,200
7.	District of Kobdo	55,450
8.	Chinese	105,500
9.	Russians and other Europeans	5,000
Total		790,750

Djan Dtak tu Wang, a Mongol Prince, with his dog and retainers

A High Mongol Lama

With an area of 1,150,000 square miles the average density of population is 51 per square mile with 42 per square mile of purely Mongol population.

The nomads who roam within the boundaries of Mongolia, are divided into several tribes, the chief among which are: Halhas 520,000, Durbats 47,000, Dzahalins, Mininggits, inhabitants of Urianchais and other. These tribes are divided into social classes as follows: Princes, nobles, freemen, serfs and the Lamas. The proportion of these classes is as follows: princes 1 per cent., nobles 5.6 per cent., freemen 26.2 per cent., serfs 16.6 per cent. Lamas 44.6 per cent., others, 7 per cent. It will be seen that the Lamas comprise nearly half of the entire population.

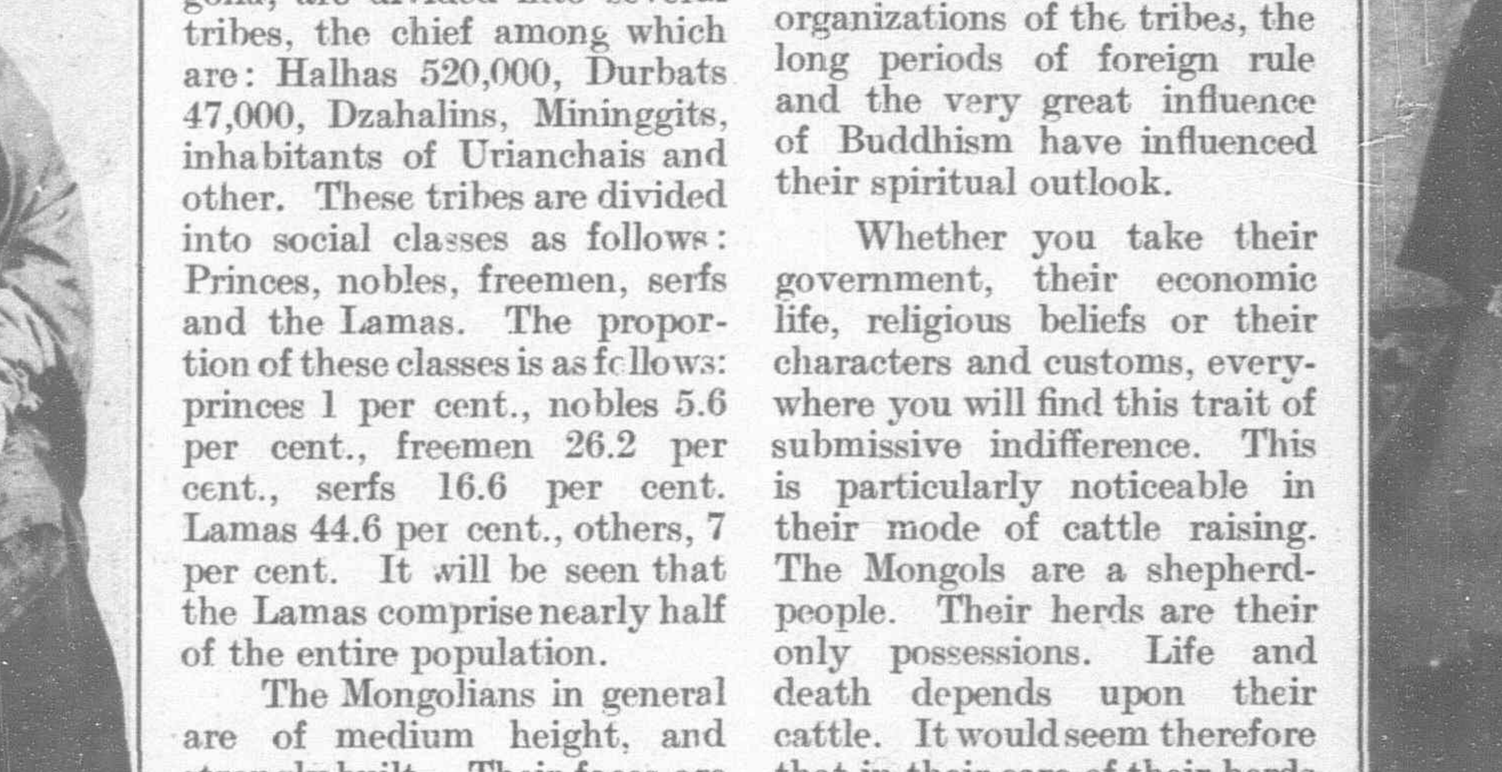
The Mongolians in general are of medium height, and strongly built. Their faces are broad with prominent cheek bones and a flat nose, the skin is light brown, a little darker than that of Europeans, their eyes black and very bright resembling narrow slits; their teeth are as white and shiny as mother-of-pearl, the ears stand out from the head, they have scarcely any hair on their faces. One very rarely meets a Mongol with either a beard or a moustache, the hair on the head is thick and black as a crow's wing. The difference between a man and woman is very hard to detect in Mongolia, since the men have no hair on their faces and their clothes are very much alike. It is often very difficult to know whether you have a man or a woman before you since both shave about half of their heads while the rest of the hair is braided into a tight plait behind.

Generally speaking the Mongol are a strong people and taking into consideration the hardships of their life, enjoy good health. However, the complete absence of culture and a nomadic life has resulted in a number of diseases many of which are infectious. The infant death-rate is enormous.

The chief traits in the spiritual outlook of a Mongol is his deep passiveness. The consequence of the physical conditions of the land and its history. The great distances, harsh climate, sterile soil, insufficient irrigation, poor vegetation and inhospitable deserts have left their impress on the people. The low economic status, the opposition to cultural growth, the rule of despotism in the inner political organizations of the tribes, the long periods of foreign rule and the very great influence of Buddhism have influenced their spiritual outlook.

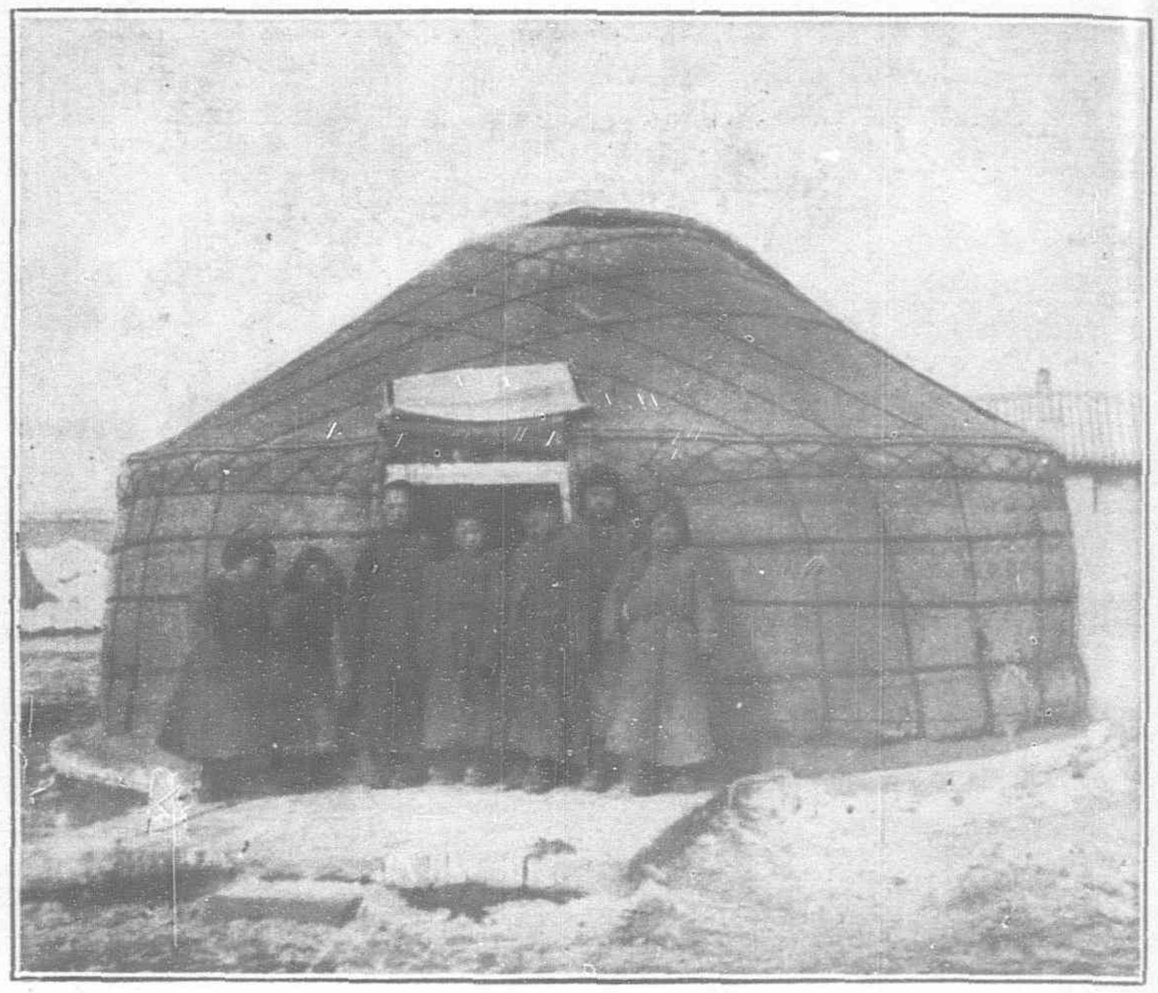
Whether you take their government, their economic life, religious beliefs or their characters and customs, everywhere you will find this trait of submissive indifference. This is particularly noticeable in their mode of cattle raising. The Mongols are a shepherd-people. Their herds are their only possessions. Life and death depends upon their cattle. It would seem therefore that in their care of their herds they would spare neither time, strength nor energy. It would seem that through those thousands of years of practical experience they would have worked out some elementary system for the care of their cattle and treating their various maladies. They have done nothing. The herds roam the year round about the wide steppes. The Mongols do not grow oats or barley; they do not build warm stables or sheds and the herds are exposed to the full rigors of winter. In consequence, hundreds of horses, oxen and

A Mongol Prince

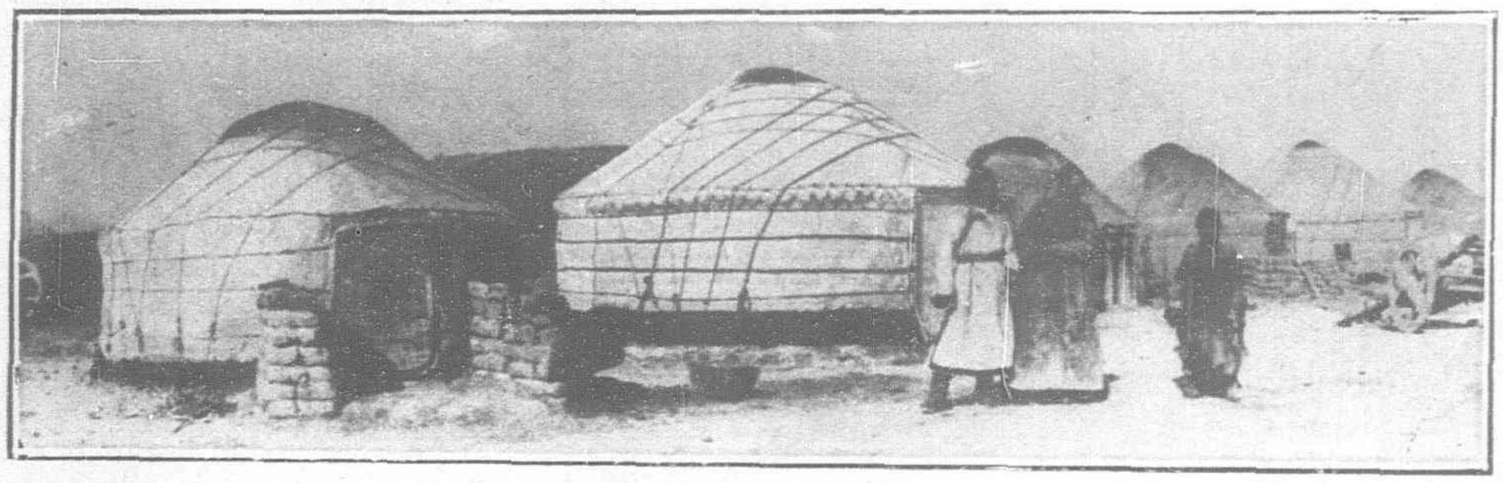


A Lamasery in Mongolia

The Home of a Mongol Prince



A Mongol Yourt



A Mongol Encampment

sheep perish yearly of hunger, cold, snowstorms and spring tempests. Their veterinary knowledge is a pitiful collection of superstitions and in any more serious epidemithey are quite powerc less. For instance, at the time of the yearly plagues which decimate the cattle, the Mongols calmly sit by and passively watch their riches disappear, calling it a visitation of God upon the people for their sins. The Russians introduced antitoxines and earned the good-will of the natives. In addition to their apathy they are extremely lazy, time means nothing.

The Mongol lives in dirt and uncleanliness. The use of soap is unknown. His face and hands he sometimes rinses in cold water but his body is never washed, and in time his skin is covered with thick crust of dirt. The dresses worn by the Mongols are never washed. They are never taken off until they drop off themselves. Their bodies exude a specific perfume which causes a European to gasp. In their home dirt reigns supreme everywhere.

Excluding a few of the higher lamas and princes the ignorance of the people is abysmal. Strange and ridiculous superstitions influence their daily lives. Another trait is an extreme curiosity and thirst for knowledge. Some of their agreeable traits, however, are cheerfulness, good nature and hospitality.

The Mongol sex relations are extremely simple and astonish an outsider with their laxity. In their tolerence towards the birth of illegal children is seen the instinct of self-preservation in a people faced with slow extinction.

In order to complete this outline of Mongol character we must mention his honesty and above all his love of peace. And when, at the present time, we look upon these good natured cheerful herdsmen, who fear nothing more than bloodshed, it is difficult to believe that seven centuries ago their ancestors came down with blood and fire upon their neighbours and in a very short time subjugated almost half of the world and created one of the largest empires that humanity had ever known. How little is left of the past!!! This astonishing and unbelievable change is one of the interesting riddles of history which has not been solved so far.

Dutch Indies and Palm Oil

West Africa's greatest asset of palm oil is likely to share the fate of wild rubber at the coming of the plantation product, according to a report which Sir Hugh Clifford, the governor of the vast territory of Nigeria, has just placed before its legislative council to call attention to the competition of the Dutch East Indies in this product. At present the collection, preparation, and export of wild palm oil is still Nigeria's main industry, notwithstanding the rise of tin mining, cultivated shea and grond nuts, cocoa, and so on. No less than 200,000 tons of palm oil are exported annually from Nigeria alone, but that is far from representing its full capacity.

Large-scale palm oil planting has been going on in the Dutch East Indies since the war. Sir Hugh Clifford told his hearers that the trees would be coming into bearing shortly. By modern machinery, such as will be used in the Dutch East Indies, at least 90 per cent. of oil is extracted. On the other hand, the average yields of oil, all over West and Central Africa, by native processes, are 35 to 40 per cent. It is, moreover, as at present carried out by hand, an arduous process and would become much dearer if the women, who at present chiefly prepare it, should leave it to the men to do. Mechanical extraction also treasures a cleaner and better quality of oil than that won by native methods. In view of these facts, the governor of Nigeria offically advocated the erection of central factories by European capital, which could handle much larger quantities and on up-to-date lines.

South Manchurian Railway Projects

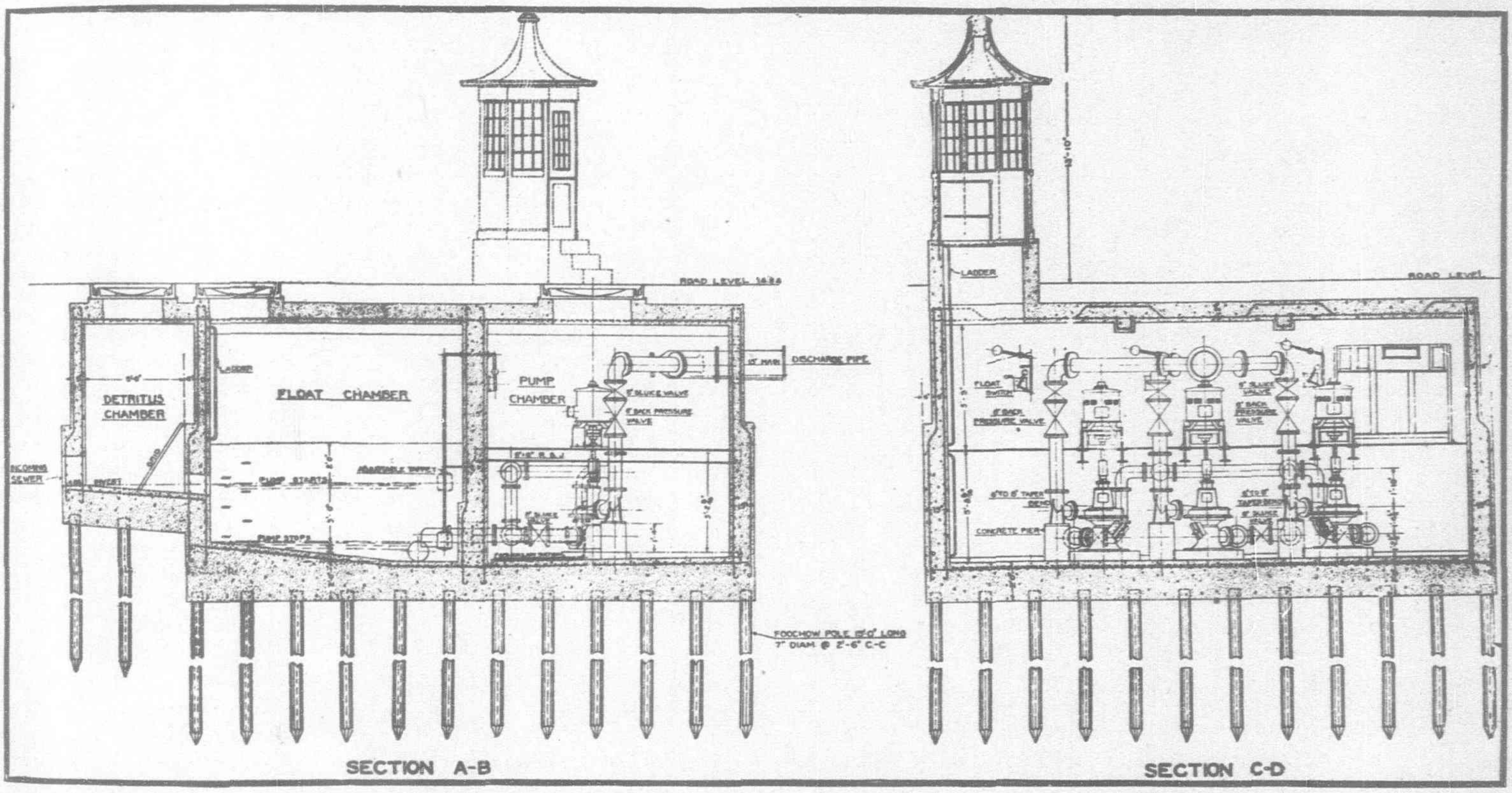
According to the president of the South Manchurian Railway Company, the sum of about 45 million yen will be available for various enterprises during the fiscal year 1924-25. This amount, which compares with 26,500,000 yen for 1923-24, has been allocated as follows: Railways, 15 million yen; harbors, 3,500,000 yen; mines, 3 million yen; ironworks, 7,500,000 yen; electrical undertaking, 3 million yen; gasworks, 1,200,000 yen; hotels, 1,500,000 yen; local administration, 8,600,000 eyn; and miscellaneous work, 2,200,000 yen.

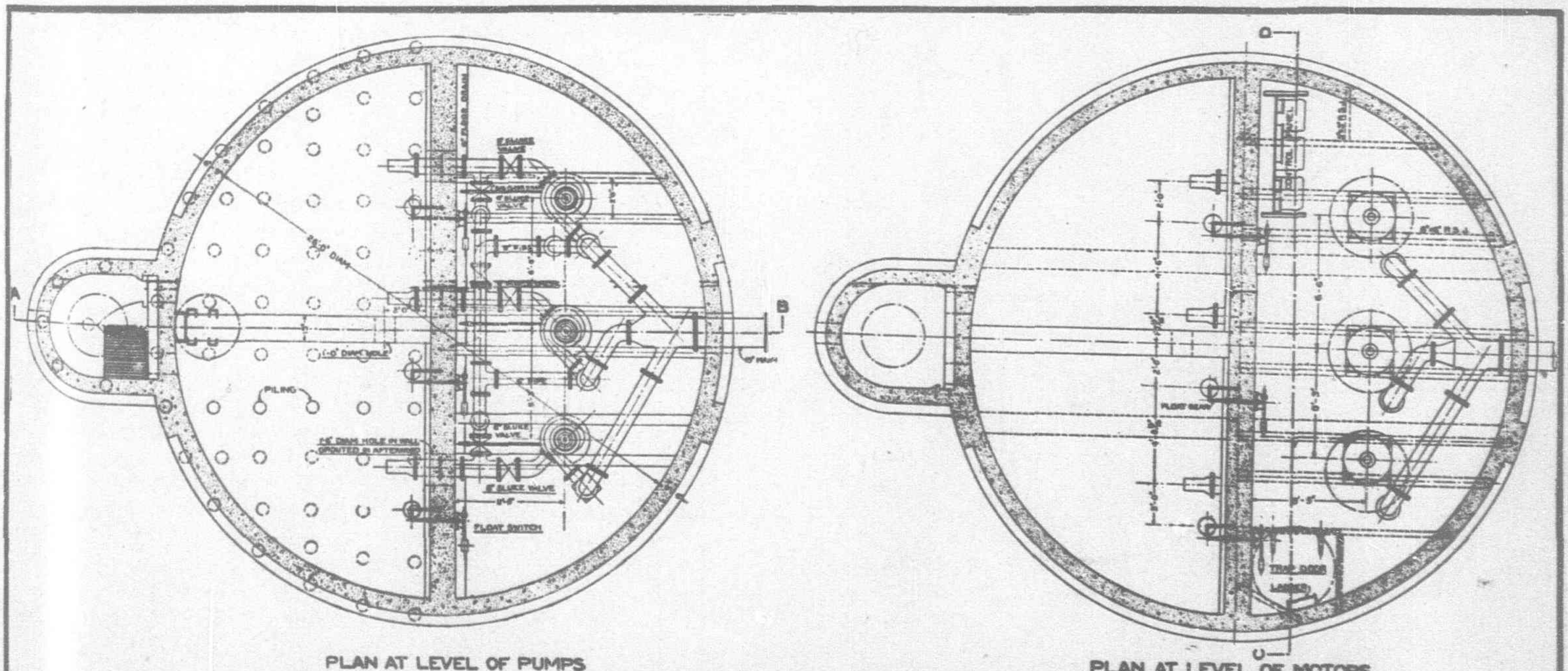
Design and Development of the Shanghai Sewerage Scheme

Paper Read Before The Engineering Society of China
By H. W. Reah, M.C., Assoc.M.INST.C.E.

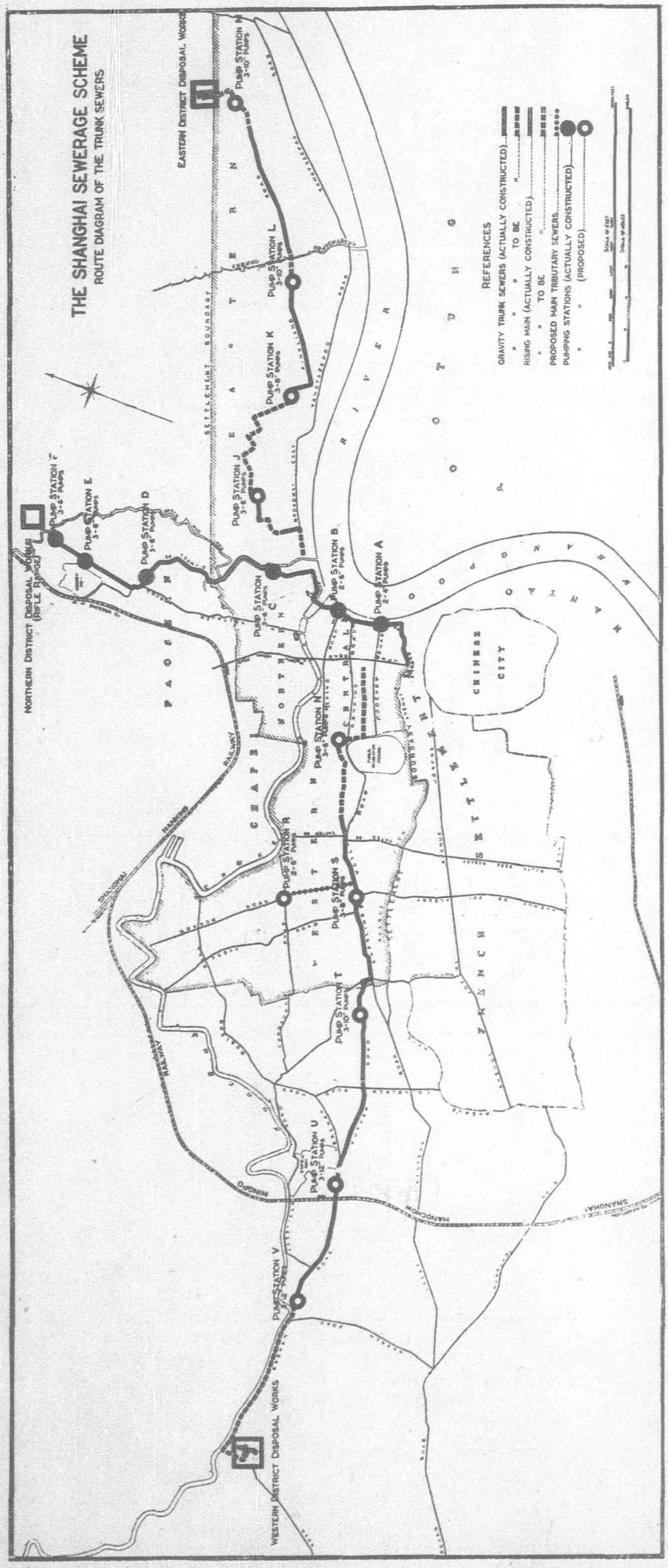
THREE years ago Mr. F. G. Helsby presented a paper on "The Present Aspect of Sewage Disposal with special reference to Shanghai," and the Council of this society has considered the lapse of this time sufficient reason to justify them in inviting another paper to deal with the development of the local scheme, the preliminary steps of which were briefly foreshadowed in the paper previously submitted.

Rather unexpectedly, and at somewhat short notice, the task and privilege of meeting this requirement has devolved upon the writer, and it is his hope therefore, that a more sympathetic consideration will be given to his efforts on this account.





The Shanghai Sewerage Scheme: Typical Pumping Station: Dixwell Road (three 6" vert. Spindle Stereophagus Pumps)



At the outset it may be stated that the object of the paper is neither to reiterate the merits and demerits of the various methods of sewage disposal or their constructional details which have been discussed so freely by experienced engineers in recent years both in England and America, nor to make any references to the bio-chemical side of the subject. What is aimed at here is to endeavor to give some indication of the engineering and economic considerations upon which the scheme is based, and a somewhat general description of the works which have already been carried out and of those which are now contemplated to assist in raising the level of the sanitary facilities of this important and rapidly developing port to those existing in western communities.

Evolution of the Scheme

Mr. Helsby in his paper dealt with the sanitary conditions prevailing and traced the immediate causes which precipitated this scheme for sewage disposal, from the decision of the court of consuls in 1915 which gave property owners power to instal water closets in their buildings whilst holding them responsible for the removal of their contents. The work in practice was performed by the council, and the ever increasing activity in the provision of water closets and their consequent cesspools from this time onwards, necessitated the introduction of vacuum tank wagons to cope with a situation which was rapidly getting beyond the practical employment of the ordinary hand-pumps. In January 1921 the council decided to proceed with the construction of the first instalment of a modern sewerage system, as it was obvious that if the vacuum tank wagons were to remain the solution of the problem, a very large fleet of these expensive and undesirable vehicles would soon be required.

The method of dealing with the sewage on the inception of the proposed water-borne system of collection was a subject for expert opinion, and the advice of Professor Fowler, D.SC., F.I.C., one of the most eminent authorities in these matters, was sought and was embodied in his report to the council in 1918, in which he recommended the adoption of "The Activated Sludge Process."

Preliminary Experimental Work

The first attempt to treat sewage on these lines in Shanghai was dealt with at a small experimental works completed in July 1919 at Yangchow Road, the sewage being delivered there by the vacuum tank wagons. The fill-and-draw method of operating was adopted here, the supply of sewage being irregular. Subsequently, additional works were carried out to provide for experiments on continuous flow. The first of these, which receives the sewage from a water flushed latrine situated at Wayside wharf, and which is frequented by over 500 Chinese daily, was first used in June 1921.

The second, on the Kinnear Road estate, forms part of a complete miniature sewerage system, being fed by sewers from a group of 35 houses. An arrangement was arrived at in this case whereby the whole cost of the installation was borne by the Shanghai Land Investment Company, the council undertaking responsibility for maintenance only.

A third experimental works, on the continuous flow method, which is more generally favored for larger works, was constructed in December 1920 on the actual site at the rear of the rifle range on which it was proposed ultimately to lay out the first working scale plant. The condition of the sewage arriving at this latter experimental station was similar to that delivered to the original Yangchow Road works, being stale cesspool contents, and was discharged by the tank wagons into manholes near the entrance to the ranges from North Szechuen Road, gravitating from here to a temporary 2½-in. pump near the 500-yard firing point, and then again to a similar pump adjoining the tanks through a 3-in. galvanized iron pipe.

Conception of the Main Scheme

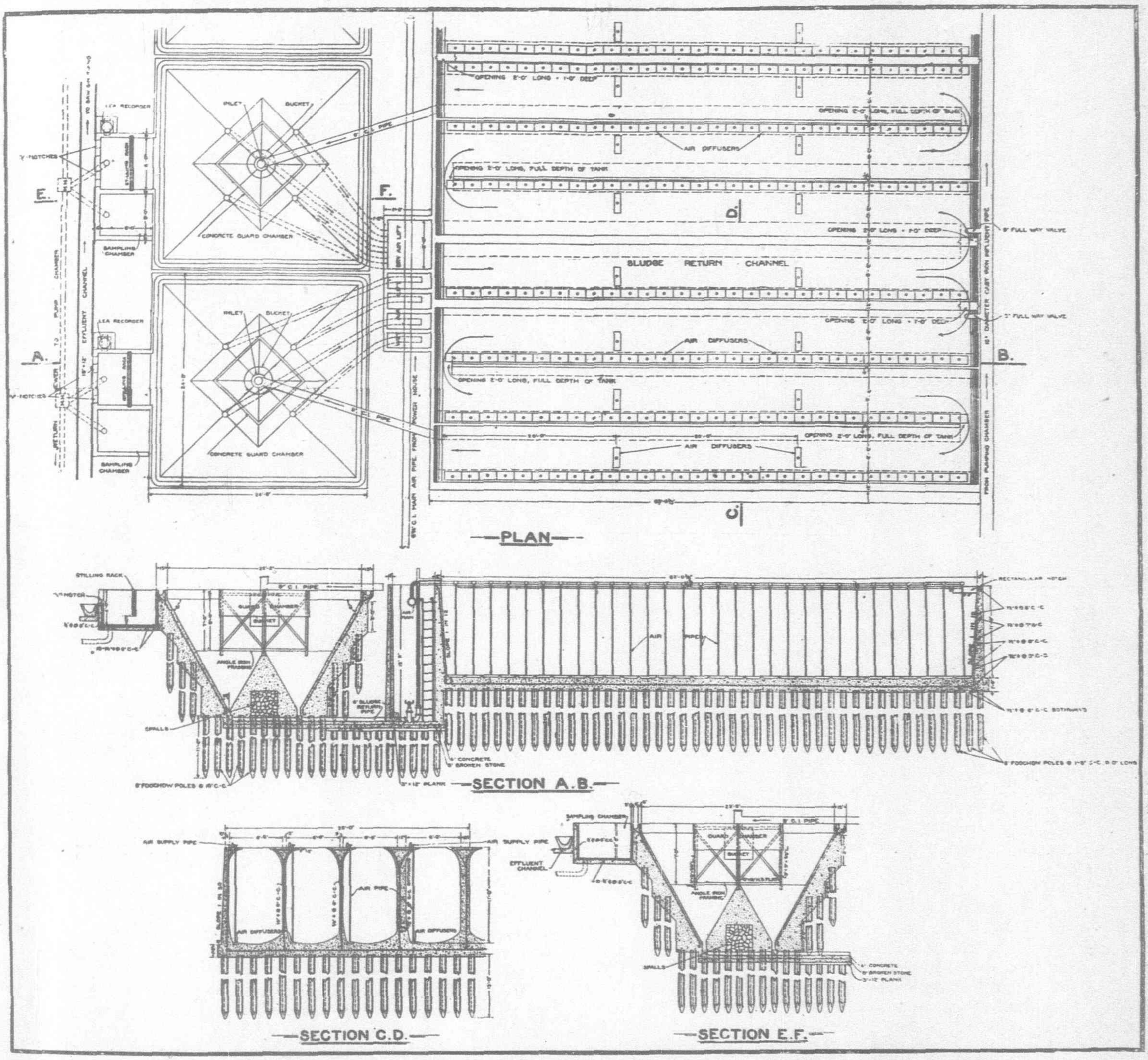
It was intended from the beginning that the finally developed scheme should be a comprehensive one to provide for the entire international settlement as existing, regard being also given to adjacent areas of potential development. The ideal arrangement of the layout of a sewerage system would normally be one to collect the sewage at one suitable site, in order to :—

1. Reduce the capital cost, maintenance and operating charges of the disposal works to a minimum.
2. Facilitate the control of the treatment of the sewage.

It was apparent, therefore, that separate works would ultimately be necessary for the eastern and western districts in the completed scheme.

First Section of the Scheme

The urgency of dealing with the business area of the central district east of Honan Road, however, coupled with the difficulty of obtaining a suitable site at a reasonable cost within settlement limits at which to treat the sewage from this area, resulted in the immediate selection, for disposal works purposes, of the area of land



The Shanghai Sewerage Scheme: Plan Showing Actual Development of Northern (Rifle Range) Treatment Works

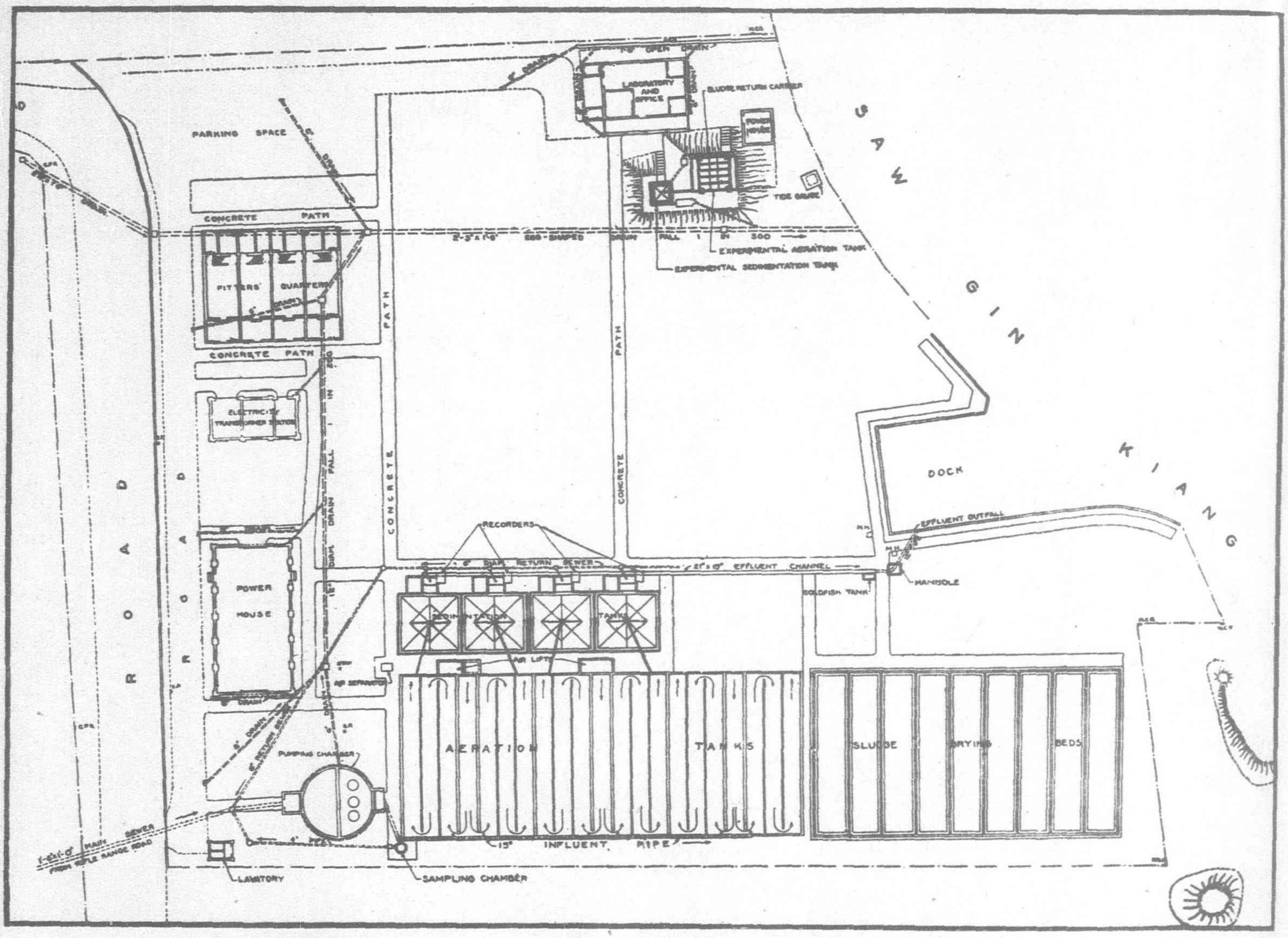
It would have been impracticable to discharge the whole volume of the local sewage to a single site, owing to a combination of the following factors :—

1. The prohibitive cost of land in or near the centre of the town assuming it were available, and that there were also no objection to treatment works being situated in close proximity to a highly developed area.
2. The great length of the settlement from east to west as compared with average width from north to south.
3. The extreme flatness of the ground throughout.

at the rear of the rifle butts which was already owned by the Council. This site, though perhaps not ideal, was considered favorably as providing both :—

1. A suitable outfall for the final effluent.
2. A ready means of disposing of the sludge.

This first section of the scheme is in reality self-contained, so that detailed consideration of it may be justified here before the whole layout is referred to, as it is felt that in this way a better appreciation of the " Development of the Scheme " will be obtained.



The Shanghai Sewerage Scheme: Plan and Sections of Aeration and Sedimentation Tanks

Calculation of Sewage Flow

The actual volume of sewage to be dealt with in a given time from a particular area cannot be determined with any degree of exactness, the most careful consideration giving results which can only be regarded as approximate. With a combined system of storm and soil water the problem usually resolves itself into a thorough examination of the watershed areas with special reference to rainfall, permeability of area, and the times of concentration of the flood water. The actual figures for the soil water would in this case influence the calculation a surprisingly small amount. The writer remembers, some years ago, illustrating diagrammatically the effect of converting an area from a privy to a water closet system to satisfy public anxiety re the ability of existing drains to carry the increased total volume of water. Even in the case of drains of small diameter, the added discharge from the water closets when the pipes were running half-full, was represented by little more than a line on the cross section to half-full size scale. This is mentioned because of the surprise expressed locally that most of the tributary sewers being laid were only 9-in. in diameter. With a system like that under review, however, where storm water is excluded from the sewers, the calculation of sewage discharge is none the less difficult.

The chief factors which have had to be considered here, are :—

1. The estimated water consumption for sanitary purposes per head of the population, both native and foreign.
2. The habits of the community as affecting the times of maximum flow and the percentage of the total daily discharge that this flow represents.
3. Thie estimated increase of population within the period of development assumed.

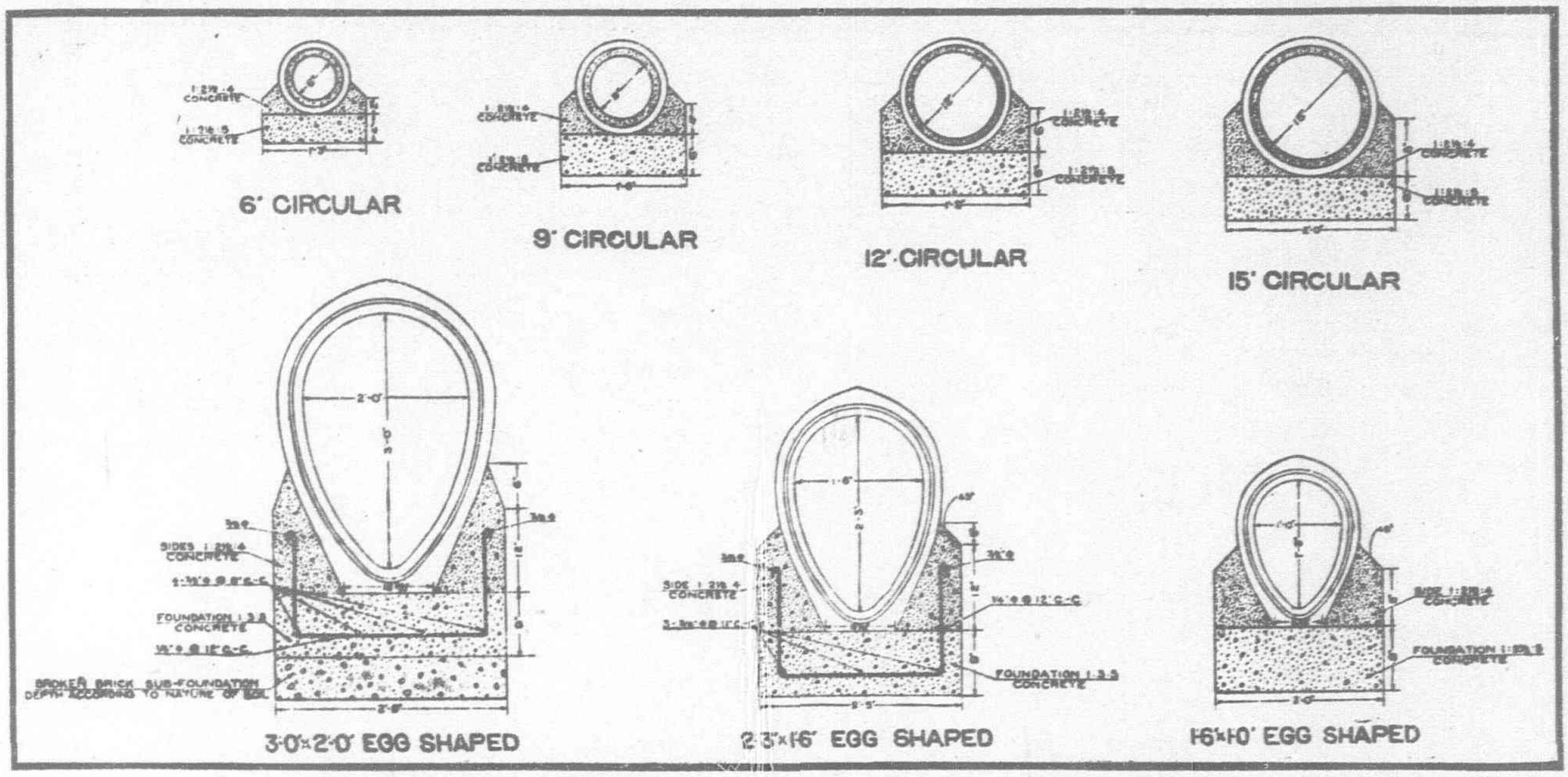
Preliminary ideas were gathered from a return of persons employed in a large number of the principal business premises in the eastern portion of the central district, and the assumption was made that ultimately similar development would take place in the remainder of this area. The daily influx of residents to this district from the outskirts, particularly from the west, was also important, this latter fact bearing on the question of maximum flow. The period of development assumed as a basis of calculation for increase of population has been taken as approximately 30 years.

The actual capacity of the rifle range treatment works as constructed to date is somewhat less than that which would be necessary to cope with the total sewage discharge from the portion of the central district previously referred to, and that from the northern district. The stay of the sewage in the tanks naturally influences this calculation, but normally, 1,000,000 gallons of sewage could now be dealt with per day, if necessary.

This amount, of course, is greatly in excess of present requirements, but the object is to be able to treat temporarily at this site part of the sewage which will later be dealt with at the proposed eastern and western disposal works. It will thus be possible for the vacuum tanks to discharge their contents into the northern trunk sewer at several points, which will enable these vehicles to gradually extend their usefulness by eliminating the more objectionable hand-carts.

First Main Trunk Sewer and Its Tributaries

The actual route followed by the trunk sewer from the Bund to these works is indicated in the diagram (Sheet 1), and the construction of it was commenced in April 1921. The portion between pumping stations A. and B. is 12-in. diameter, and the whole of the remainder of it right through to the disposal works is of 1-ft. 6-in. ×1-ft. 0-in. egg-shaped section with the exception of two lengths of rising main. The first of these latter sections is required to convey the sewage over the Soochow creek and the other, to convey it over the Hongkew creek and the Sawginkiang. The former is 1,250



The Shanghai Sewerage Scheme: Typical Cross Sections of Sewer Construction

feet in length, 812 feet of which is constructed of 12-in. concrete pipes encased in reinforced concrete 6-in. thick from pump station "B" at the end of Peking Road to the garden bridge; the remaining 438 feet being 12-in. C.I. socketted pipe carried under the eastern footway of the bridge itself. The latter pumping main is 3,115 feet in length, 151 feet of which is cast iron socketted pipe, 71 feet being 15-in. circ and 80 feet 17-in. × 12-in. oval section required for the approaches to, and the actual crossing of, the Hongkew creek at the new Hanbury Road bridge. Special provision was made in the design of this bridge for this pipe. The remainder of this pumping main is constructed of 15-in. concrete pipes similarly encased to those in the Bund, and extending along Dixwell Road and over the west side of the bridge over the Sawginkiang. The section crossing this creek is 114 feet in length, and is cantilevered out from the footway above the road level.

As the reconstruction of the Hanbury Road bridge was not sufficiently far advanced in March 1923 to lay the cast iron main in it; in order to avoid delaying the inauguration of the system, a temporary 6-in. galvanized iron rising main with screw union joints was carried over the creek a little to the north on a temporary timber trestle of 66 feet span. This was dispensed with in November 1923 when the larger pipe was laid.

The majority of the tributary sewers gravitating to the Bund as well as those in the northern district are of 9-in. internal diameter and have been designed to gradients which will give self-cleansing velocities throughout, viz., 2½-ft. per second, though the initial additional velocity given at each pumping station has, in some instances, been taken into account as assisting in producing this velocity rather then adding to it. No natural fall being available, the importance of keeping the grades as flat as it is safe to do so, will be readily recognized, so as to minimise the number of times the sewage has to be lifted in its passage to the disposal works; pumping stations also incurring capital, maintenance, and operating expenses.

Pumping Stations

Appendix I is a schedule of the pumping stations that have actually been built and give particulars of the motors and pumps installed in them. The relative positions of the stations will be followed on the diagram.

With the exception of station "F" at the rifle range, they are all entirely underground and are constructed of reinforced concrete on Foochow pole pile foundations. The first to be proceeded with were those at the ends of Foochow and Peking Roads on the Bund and were commenced early in May 1922. The cofferdams were constructed of 12-in. × 6-in. Wakefield sheet piles 25 feet long, strutted with 12-in. × 12-in. Oregon pine. The majority of the stations are circular in plan, as shown on sheet II, which is station "D" on Dixwell Road and is a typical design. The Nanzing Road station is of special design, owing to the narrowness of the roadway—the float chamber being a long, narrow channel instead of being semi-circular as in the other instances.

A dividing wall separates the float chamber from the pump chamber proper, this latter chamber being divided into two in elevation by a chequer plate floor supported by rolled steel joists. The upper half accommodates the motors and switchgear, and the lower half, the pumps themselves. By standing primed automatic operation of the pumps is possible. Entrance is effected to the pump chamber at each station by means of a small kiosk built over a manhole, but station "F" has a storey entirely above ground, giving freer access and facility for observations. It would have been impossible, as well as being unnecessary, however, to provide this additional floor at every station, and ventilating shafts have been erected in lieu.

The well-known Parson's stereophagus pump has been installed thoroughout.

In each station one of the pumps is a stand-by in case of emergency and the others are designed to cope with the maximum flow that this sewer will ever be called on to discharge, allowing a reasonable margin.

Electricity supplies the motive power for the pumps and is delivered by underground feeders. In case of failure, an alternative supply is available from the ordinary distribution mains. Vertical spindle pumps were adopted instead of the horizontal type to allow of the motors being placed as high up in the chambers as possible.

The motors are started and stopped automatically by means of floats which are actuated by the rise and fall of the surface of the sewage in the float chamber, these floats being fixed at slightly different levels. The motor connected to the lowest float comes into service first, the others being brought into operation by the continued rise of the sewage due to the first one being either overpowered or failing to act.

In designing the pump stations, the surface area of the sewage in the float chambers has been kept as large as was practicable in order to reduce the variation in the level of the sewage, thus avoiding unnecessary lift. The suction pipes which are led through the dividing wall between the float and pump chambers have specially shaped ends to prevent floating obstacles, such as wood, from blocking the entrance to the pumps. Small detritus or screening chambers have been provided as an additional safe-guard against the choking of the pumps themselves.

In the remote possibility of a complete breakdown at any pumping station the float chamber in each is provided with a bye-pass by which the sewage could gravitate to the next pump station.

The level of the sewage in the float chambers is indicated in the pump chambers by the use of Liquid Level Recorders, and by which means a check is kept on the operation of the pumps.

Arrangements are now being made to have all the indicators installed at the Disposal Works and operated on the Bristols' Long Distance Electrical Transmitting and Recording System.

Comparison of Methods of Lifting Sewage

The various other methods of raising sewage were, of course, given due consideration before it was decided to adopt the stereophagus centrifugal pump, and of these, pneumatic ejectors, which have been successfully used under similar conditions elsewhere, proved the closest rival. The use of this latter method, however, would have necessitated either :—

1. Main air compressing stations involving long lengths of air mains that are liable to give trouble, or
2. A compressor at every pumping station.

The use of ejectors might also have entailed adequate provision being made for screening the sewage at the disposal works as it is very desirable, particularly with the activated sludge process, that the solids should either be removed or broken up as much as possible before the actual treatment commences.

The required lifts being low, there is no disadvantage under this heading in the use of centrifugal pumps, which have a distinct advantage in their power of disintegrating the sewage.

A major consideration in the selection of the pump to be employed, more particularly perhaps in cases like that under review, where every endeavor is being made to rigidly exclude all surface water, is that there shall be no possibility of the choking of the pumps through their failure to pass the fibrous and solid matters ordinarily found in the sewage. It is the ability of the type of pump adopted to do this which gives rise to its name " Stereophagus " (literally " an eater of solids "), and the result is obtained by a conical impeller with spiral blades working against a straight cutting blade.

Rifle Range Disposal Works

The general layout of the rifle range treatment works is shown on sheet III. The description of the cycle of operations carried out in the treatment of the sewage in the activated sludge process has previously been given very lucidly, though with particular reference to the experimental works. The principle, however, is precisely the same in the new works, so that repetition is unnecessary and only points of constructional detail need be dealt with here.

In brief, there are six aeration units and four sedimentation units. Each of the former consists of three channels 60-ft. long, 6-ft. 6-in. wide and 11-ft. deep with a similar channel between each set to convey the returned sludge from the sedimentation tanks back again for re-aeration. The volume of each unit is approximately 80,000 gallons and of each sedimentation tank 20,000 gallons. Sheet IV gives plan and sections of the first-two aeration units and two sedimentation tanks, one complete unit being first put into operation in December, 1922.

A row of " Filtros Plates " or diffuser tiles is fixed along the the bottom and at one side of each aerating channel the alternate ends of which are open the full depth of the tank to allow the sewage to continue on its journey. Parabolic curves have been introduced into the design of the cross section of the tanks, and the diffusers specially placed at one side in order to improve the circulatory motion of the sewage in its passage along the channels. Some transverse diffusers have also been put in to prevent short circuiting. The division walls of these tanks are only 4-in. thick, centrally reinforced, being merely partition walls, while the walls of the return sludge channel are 12-in. thick reinforced on the outsides, as each of these is called upon to act as a retaining wall when the adjacent unit is not being used. The sludge return channel is entirely enclosed except for adjustable rectangular notches over which the sewage flows to the units on either side. The sewage is fed to these tanks from the pump station " F " on the site through a 15-in. C.I. flanged pipe with full way valves at the required points of entry.

The sedimentation tanks are square in plan above ground level, the internal sides sloping inwards at an angle of 61°, the lower half of each tank being divided into four cone-shaped pockets from the apices of which 9-in. concrete pipes lead the sedimented sludge to the air lift chambers, in which it rises again to be discharged into the return sludge channel.

The constructional details of all these tanks are indicated on the drawings. Cast iron flanged pipes 9-in. in diameter convey the sludge from the aeration tanks to the sedimentation tanks, discharging into the latter by means of a special inlet, consisting of a vertical pipe under which a bucket is suspended. The bucket is surrounded by a square concrete guard box, built of angle iron framing supported on the ridges between the pockets to which reference has already been made. The object of this arrangement is to render the liquid inside quiescent facilitating settlement of the sludge and allowing the effluent to flow over the sill at the top of the tank Before the effluent from each set of tanks is finally discharged into the effluent channel leading it to the creek, it is passed through stilling chambers, so that its volume may be measured accurately by Lea recorders as it flows over V notches.

Three Ingersoll-Rand air compressors each with a capacity of 441 cubic feet of free air per minute are installed in the power house to provide the compressed air for both aerating and lifting the return sludge. A common C.I. flanged air main $8\frac{3}{4}$-in. diameter tapering to 6-in. serves both these purposes and is fitted with a Venturi meter and also a Stratton separator. The distributing air pipes along the tops of the aeration tanks are $2\frac{1}{2}$-in. galvanized iron pipes, from which $\frac{3}{4}$-in. pipes of similar material are led through slots in the concrete hoods of the tanks down to the diffuser plates below. Needle regulating valves are fixed at the top of each of these vertical pipes. The sludge is lifted up to the aeration tanks in 4-in. galvanized iron pipes : the air being introduced into the bottom of these and under diffusers through $\frac{1}{2}$-in. piping. At intervals the returned sludge, as it leaves the air lifts, is conveyed by means of a portable flanged pipeline on to drying beds formed of coarse sand which have adequate under-drainage. The liquid drains back to the pumping station, leaving the more or less solid product to be removed as soon as it is sufficiently dry to handle.

A dock 40-ft. wide and 70-ft. average length has been constructed on the creek for the purpose of disposing of the sludge by boat. Tongued and grooved reinforced concrete sheet piles 14-ft. long, 2-ft. 6-in. wide and 7-in. thick were driven 7-ft. to a slight batter and a concrete coping cast along the heads.

A transformer house and a laboratory have also been built on the site, and fitters' quaters are now nearing completion.

General Construction

The majority of the works have so far been carried out by direct labour, as it was considered that the pipework would be more efficiently executed by this means, and it was also desirable to be in a position to modify the details of the design of the treatment works from time to time as experience and later information directed.

Considerable difficulty in construction was experienced as a reault of water and the instability of the subsoil. The construction of the sedimentation tanks being the deeper, preceeded that of the aeration tanks. Typhoons in 1922 caused considerable damage to the cofferdams. Since completion, however, little or no settlement has taken place, though slight leakage from the first and second sedimentation tanks was noticed some time ago and was found to be due to damage sustained by the return sludge pipe under the tanks, but this has now been rectified.

Progress in the Construction of the Tributary Sewers

The whole of the central district lying to the east of Honan Road has now been sewered and with nine exceptions every building which up to the present has been dependent upon a cesspool has been connected up to the system. The majority of the sewers in the western half of the central district, south of Nanking Road, have also been laid. This work has entailed very considerable difficulty and required the most careful attention both in arranging the gradients so as to reach all points successfully and in avoiding as far as possible the necessity of making expensive alterations to the network of underground service pipes of the various utility companies. The available information regarding the position and depth of these existing mains was from a variety of understandable causes very often inaccurate, and rather extensive trial holes have usually been essential prior to excavating any particular line. The narrowness of the roads together with the great volume of traffic of every description which traverse them, and the fact that the trenches

were flooded at every high tide necessitating close sheeting, all contributed to slow down the rate of progress of the work particularly as every section of pipe was subjected to a water test before reinstatement of the roadway was commenced. The combination of these conditions in the construction of a sewerage system is probably unique.

Prospective Development of the Scheme

The attention of the department is now being directed to the provision it will be necessary to make for the northern, eastern and western districts. The sewage from the central district west of Honan Road, as well as the whole of that from the western district will travel to proposed disposal works situated approximately four miles west of Bubbling Well and close to the banks of the Soochow creek into which the effluent will finally deliver. The entire eastern district sewage will deliver to proposed disposal works to the north of the junction of Kueiyang and Hochien Roads, the effluent in this case discharging *via* Pingliang Road to the Whangpoo River.

The routes followed by the trunk sewers concentrating on these sites, and the proposed positions of pumping stations will be followed by again referring to Sheet 1, which is at the same time a progress plan showing the portions of the lines which have already been completed and those which have yet to be laid.

Western District Trunk Sewer

The western main sewer travels in a westerly direction from Honan Road *via* Hankow Road to Thibet Road, northwards to Burkill Road and along Burkill Road to Carter Road, thence *via* Yuyuen and Brenan Roads. The size of the pipes increases from 12-in. circ. up to pump station N; 2-ft. 3-in. by 1-ft. 6-in. Egg-shaped up to the junction of Carter and Bubbling Well Roads 3-ft. by 2-ft. Egg-shaped to the works. Under the Shanghai-Ningpo Railway Company's level crossing immediately south of Jessfield Railway Station, however, a 30-in. C.I. flanged pipe will be laid on a reinforced concrete foundation to obviate any possibility of breakdown which might occur as a result of damage to a 3-ft. by 2-ft. concrete pipe. The crossing of Fahwa creek will be effected by a 30-in. C.I. rising main from pump station "V" and a further section of rising main will be necessary at the disposal works.

Eastern District Trunk Sewer

The eastern district trunk sewer travels by a rather circuitous and zig-zag route from a point immediately to the east of the Hongkew creek at Broadway *via* Yuenfong, Tongshan, Singkeipang, East Yuhang, Chusan, Tongshan, Alcock, Kwenming, Paoting, Baikal and Dalny Roads to Pingliang Road and then along the entire length of this latter road to Kueiyang Road where it finally turns northward to the disposal works.

The route almost entirely avoids tramway tracks and meets with the minimum obstruction possible from underground sources.

The size of the pipes increases from 12-in. in Broadway up to Yuenfong Road 2-ft. 3-in. by 1-ft. 6-in. up to Tsitsihar Road and 3-ft. by 2-ft. from this point to the disposal works. Approximately 1,000 feet of 24-in. diameter rising main will be required from pump station "L" to cross the Yangtszepoo creek, the portion of this actually crossing the creek will be of cast iron pipes and like the main over the Fahwa creek will most probably be carried independently of the existing bridge to avoid difficulty when the time comes to widen this structure.

Proposed Pumping Stations

Appendix II is the schedule of the additional pumping stations which it is estimated will be necessary when the whole settlement has been sewered.

Tenders have already been invited for the supply of the motors and pumps for these, with exception of stations "G" and "H" in the northern district and "O," "P" and "Q" in the western district. These have been omitted as it will be a considerable time before they can be dealt with, and their positions have not been indicated on the diagram, firstly, so as not to complicate this unnecessarily and secondly, because circumstances may require the selection of alternative sites.

Eastern and Western Disposal Works

Though it may be premature to make any very definite statements regarding the design of these works it may perhaps be permissible to draw some comparison with those existing at the rifle range.

Lay-out plans of the proposed new works have been completed and as soon as the working drawings, which are in preparation, have received necessary approval the construction of as much of the work as will meet existing requirements will be proceeded with.

At each site these preliminary tanks will have a capacity of approximately 1,500,000 gallons a day. The estimation of the total tank capacity that will ultimately be required and the date at which the necessity for it will occur, are factors even more difficult of solution than in the case of the northern works. The capacity of the pumping stations which will deliver the sewage direct to each works, however, will be approximately 9,000,000 gallons a day.

Both the length and cross section of the aeration tanks will be greater than those at the rifle range, the proposed dimensions being 120-ft. long and 9-ft. wide with 11-ft. depth on the diffuser tiles. Transverse baffle walls will be provided to avoid short circuiting in these very long channels if the need arises. There will be only one set of air lifts for each set of tanks and consequently only one return sludge channel. An emergency channel along the ends of the aeration tanks, however, will make it possible to direct the returned sludge into any aeration unit, whilst a second similar channel along the other ends of the aeration tank, and between these and the sedimentation tanks will deliver it to any of the latter tanks desired. Additional stilling chambers will also be introduced to control the flow to these tanks.

This flexibility in the use of the tanks is a distinct advance on the arrangement at the rifle range works by which the sludge from any sedimentation tank can only be returned to one of two adjacent aeration units. The emergency channel can also be utilized to drain any of the aeration channels at any time. In this case the liquid is carried back by an underground pipe to an auxiliary pump which lifts it into a distributing chamber where it will mix with the incoming sewage and be discharged again to the desired aeration unit.

Another change in design is of particular interest as being the direct result of practical experience gained on the present works. This is the proposal to bring the return sludge pipe from the bottom of the pockets in the sedimentation tanks, up through the tank walls into a small chamber about ground level, thereby serving the dual purpose of controlling the return flow and preventing any possibility of trouble caused through choking of the pipes.

It is proposed to construct these disposal works by contract.

Cost

No account of the design of an engineering scheme would be complete without some reference to cost and it is regretted that the time available for preparation of this paper has been insufficient to be able to give much detail under this heading. The yearly appropriations for the scheme included in the budgets since 1920 and the actual sums spent are of interest, however, and are given in the following table:—

Year.	*Appropriation.*	*Actual Expenditure.*
1920	Tls. 30,000.00	Tls. 7,623.01
1921	„ 150,000.00	„ 212,793.08
1922	„ 502,000.00	„ 493,838.60
1923	„ 538,700.00	„ 514,281.47
	Tls. 1,220,700.00	Tls. 1,228,536.16

It is understood that an opportunity will be afforded the members of this society at an early date of visiting both the council's concreteware yard where the whole of the pipes are manufactured, and the rifle range disposal works, and this it is hoped will serve to render the paper more explanatory.

Both the paper and the drawings which accompany it are submitted with the permission of Mr. C. Harpur, the commissioner of public works.

APPENDIX I.

SCHEDULE OF PUMPING STATIONS CONSTRUCTED.

Pump Station.	Position.	Number and size of Pumps installed.	H.P. Motor (each).	B.H.P. absorbed (each).	Revs. per min.	Total Head.	Discharge gals. per min. (each pump)
"A"	Bund opposite end of Foochow Road	2—4″ Pumps	3	2	700	8	300
"B"	Bund opposite end of Peking Road	2—6″ „	15	12	725	29(22 Friction (7 Lift	800
"C"	Corner of Nanzing and Hanbury Roads	3—6″ „	15	10	725	23(15 Friction (8 Lift	800
"D"	Dixwell Road 134 yds. E. of N. Szechuen Road ..	3—6″ „	6	4	570	7	800
"E"	Rifle Range (near 500 yds. firing point)	3—6″ „	6	4	570	6	800
"F"	At Rifle Range Disposal Works	3—6″ „	15	9	720	20	800

APPENDIX II.

SCHEDULE OF ADDITIONAL PUMPING STATIONS REQUIRED TO COMPLETE THE SCHEME.

Pumping Chambers.	Location.	Number of Pump.	Size of Pumps (inch).	Lift Head (ft.)	Friction Head (ft.)	Total Head (ft.)
"G"	N. Chekiang and Alabaster Roads (probable)	—	—	—	—	—
"H"	Boone and N. Shanse Roads (probable)	—	—	—	—	—
"I"	Quinsan and Chapoo Roads	3	6	14	Nil	14
"J"	Chaoufoong and E. Yuhang Roads	3	6	14	„	14
"K"	Wayside and Dalny Roads	3	8	14	„	14
"L"	Pingliang and Tsitsihar Roads	3	10	23	2	25
"M"	Pingliang and Kueiyang Roads	3	12	20	5	25
"N"	Thibet Road	3	6	14	Nil	14
"O"	Avenue and Chengtu Road (probable)	—	—	—	—	—
"P"	Mohawk and Weihaiwei Roads (probable)	—	—	—	—	—
"Q"	Gordon and Robison Roads (probable)	—	—	—	—	—
"R"	Gordon and Connaught Roads	2	6	14	Nil	14
"S"	Bubbling Well and Seymour Roads	3	8	13	„	13
"T"	Yu Yuen Road opposite Public School	3	10	13	„	13
"U"	Yu Yuen Road near Railway	3	12	14	„	14
"V"	Brenan Road near Fahwa Creek	3	12	19	1	20
"W"	Rubicon Road Disposal Works	3	12	21	2	23

Huge Order for Converters

According to advices from the Japan office of the Westinghouse Electric Intl. Co., the imperial Japanese government railways have just placed an order for sub-station equipment covering twenty 1,000 k.w. rotary converters, to be operated two in series on 1,500 v., and two 2,000 k.w. motor generator sets, 1,500 v. d.c. with automatic switching equipment.

These latter machines are for their main line electrification and will represent the largest motor generator set installation with automatic switching in the world. Westinghouse already had the largest rotary converter installations with automatic switching in the world, namely, the 8,000 k.w. station for Yokohama, which will supply the I.G.R. main line.

Anzan Cement Slag

Whether the new materials to be used in the Anshan Iron and Steel Works will render the slag unfit for cement manufacture is a question, says Mr. T. Oka, general manager of the S. M. R. Co. development works department, regarding the proposed transfer of the slag cement factory on the premises of the iron works to the Onoda Cement Co. (Dr. S. Kasai, president), operating a plant at Choushuitzu. The Anzan works originally planned to operate the slag cement plant as a by-industry, in order to supply the railway company's demand for cement.

The prospective change in pig iron manufacture in the new plant provides for the use, instead of lime stone and silicious stone as now, of dolomite ingredients occurring about Tashihchao. In such case, the slag will contain magnesia, etc., which may unfit it for cement manufacture. Therefore, nothing definite can be stated before the slag has been subjected to chemical analysis. On such premises, an understanding has been formed with the Onoda Cement Co., undertaking to render suitable support, in case of the new slag being found still available for cement manufacture.

Manchuria, Supplier of Blast-Furnace Charges

The Imperial Japanese Steel Works at Edamitsu receives from Manchuria through the S.M.R. Co. silicious stone, magnesite, and fire-clay required for its blast-furnaces. The works also owns a magnesite quarry in the Kwantung leased territory. The amount imported annually is 10,000 tons of silicious stone and as much fire-clay, besides two to three thousand tons of magnesite and 20,000 to 30,000 tons of dolomite. The government works often draws on Buzen and Tanba provinces for silicious stone, the outputs of which are of superior quality, but very dear in price, being quoted at from Y.13 and Y.8 to Y.5 per ton. The Manchurian product can be obtained at Y.3.50 per ton f.o.b. Port Arthur.

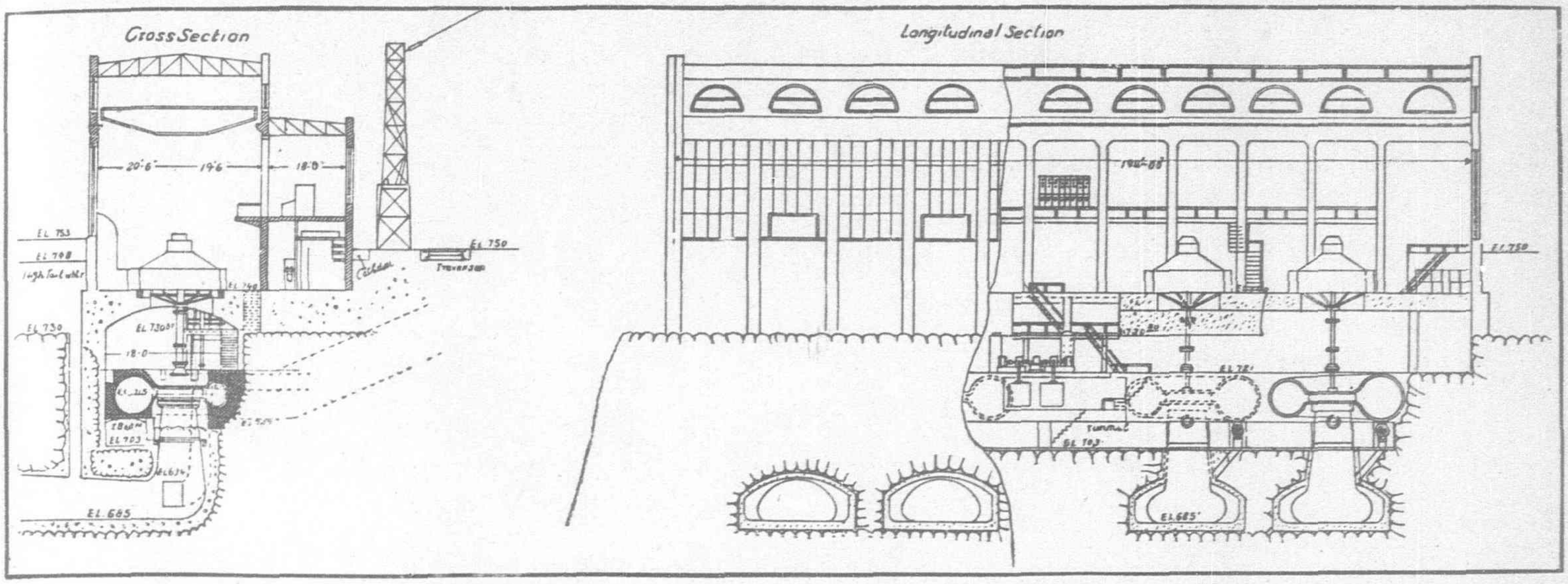
The fire-clay procured from Manchuria is excellent in quality, suitable for the manufacture of A1 brick.

Dolomite is found in abundance everywhere about Port Arthur and Dairen. The deposits of silicious stone and dolomite in Manchuria are exceedingly thick-seamed, often reaching 3,000-ft., compared with only several hundreds of feet in Japan.

Magnesite occurs in great abundance about Tashihchiao. It serves as material for making paint and lignoid, promising more extensive possibilities.

The Edimitsu blast-furnaces comprise 12 of 25 tons each, 8 of 50 tons each, and the same number of 60 tons each. For making pig-iron, four furnaces of 250 tons each and two of 300 tons each are provided. The annual steel producing capacity is 420,000 tons.

The management of the works is looking forward to a sharp increase in the demand for slag-cement and proposes to increase the present daily production of 200 barrels to 2,000 barrels.



Ohi Power Station: Equipped with four 18,000 h.p. (max.) 180 r.p.m. single spiral, single discharge, vertical type Allis-Chalmers water turbines and four 13,750 k.v.a., 80% P.F., 6,900 v., 3 phase, 60 cycles, General Electric alternators

The Ohi Hydro-Electric Power Plant

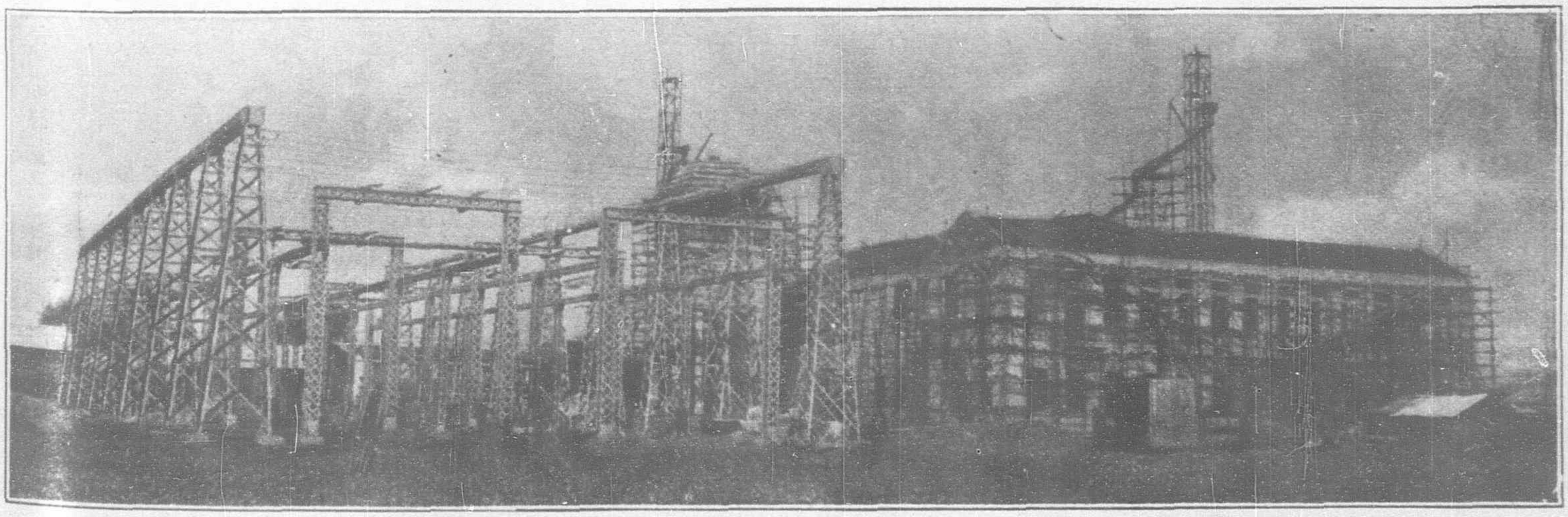
By Ernest V. Pannell

ONE of the most remarkable cities in the world is Osaka, in Japan, which unites history and tradition with modern industrial development, finance, and economic prestige. Whilst Tokio is the capital of the empire, Osaka will always be more representative of the new Japan, of factory, exchange, and shipping-dock. No visitor can fail to appreciate the significant part in the life of this city of nearly two million souls within which not only is virtually every room in every house electrically lighted, but the use of illuminated signs is apparently more widely spread than in most of the cities of the western world. A network of electric car lines covers every part of the city and links up with high-speed electric lines of heavier types operating to Kobe, Kyoto, Nara, and other points at a wide radius.

It should be admitted that Japan was quite early in the field of electric light and power development, for nearly thirty-five years ago the first electric light was produced in Osaka, and the first Japanese electric railway was initiated six years later in Kyoto. Hydro-electric power was introduced in 1891 and high-pressure transmission in 1898. It will not be surprising to learn, therefore, that modern Japanese development in electrical engineering is, at least, equally as advanced as anywhere in the world. At the present time it is estimated that our of seven million available water horse-power (based on minimum flow), one and a half millions is being harnessed to produce electricity.

Probably the most extensive power corporation in the island empire is the Daido Electric Power Co., which supplies the city of Osaka, together with Nagoya, Yokkaichi, Kyoto, and, through its affiliations, Toyama, Kanazawa, and other cities on the remote northern shore of Hondo, the central island of Japan. The Daido Co. represents the amalgamation of a number of power interests in contiguous territory under the capable financial direction of Mr. M. Fukuzawa. The business of the company is to generate electricity at the various falls of the Kiso River and elsewhere, and to sell the power mainly in the Osaka district. The capital of the company as at present subscribed is approximately £4,500,000 in preferred and ordinary shares, plus £3,000,000 in debentures, paying 7 per cent. At the time of writing, the total connected load on the system approaches 200,000 kva, and construction is in progress to increase this amount by 50 per cent.

The bulk of the power is generated on the Kisogawa, one of the "four great rivers" of Japan, there being no fewer than twelve installations of plant operating, or being constructed at different points along the valley, all having an average head of 150-ft. and having outputs rated at from 4,000 to 45,000 kw. (Ir should be remarked that, by virtue of the code of the Japanese federal

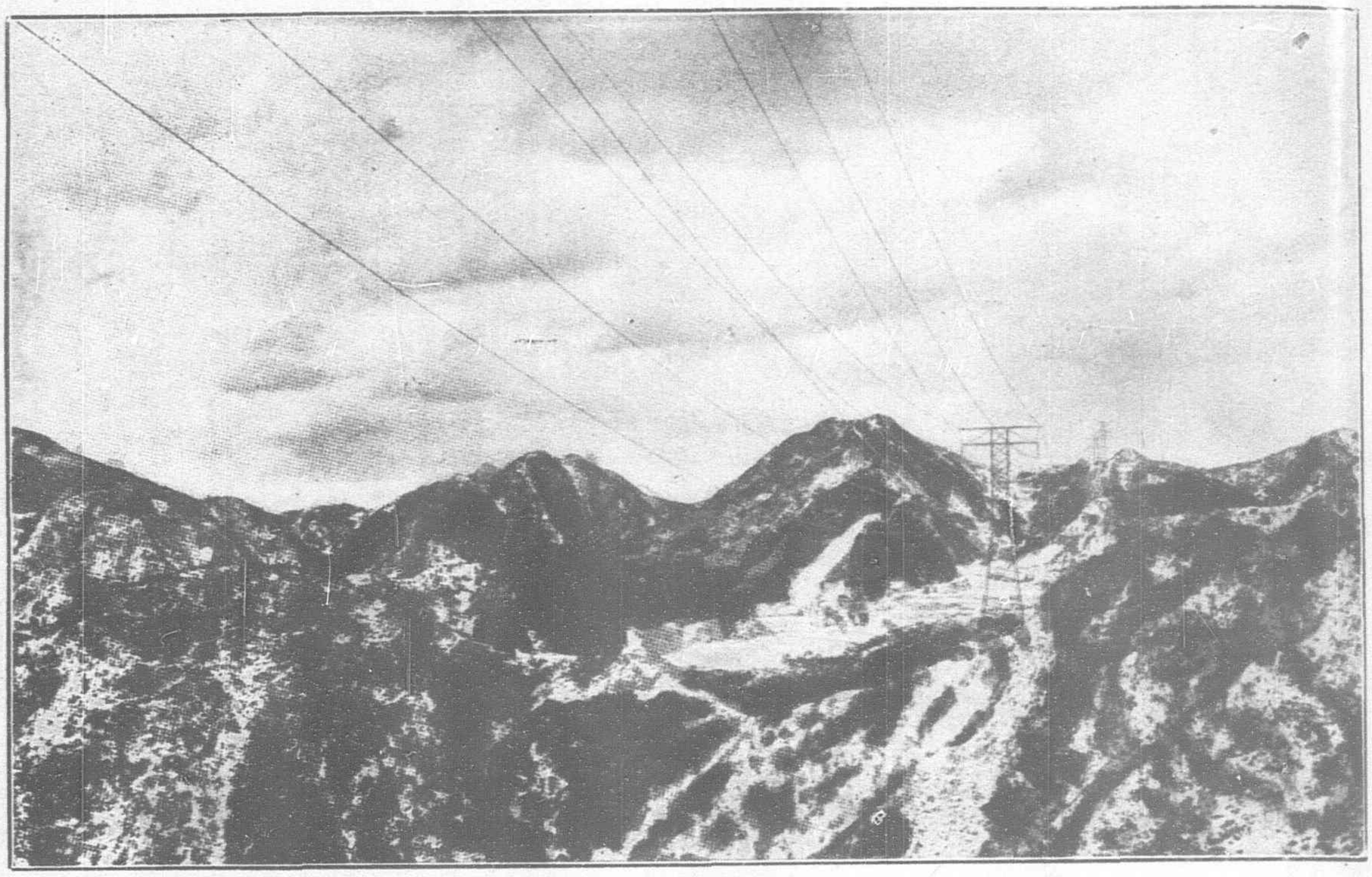


Recently Completed: Osaka Sub-Station under Construction; output 120.000 K.W.

department of communications, the plant capacity is 25 per cent. greater than the rated capacity of the stations, this margin representing a reserve.) This disposition of a series of stations along the same river provides for development at a reasonably low cost, and, although the extreme sets of plant are 75 miles apart, it can truly be said that the tail-race of one station provides the head water of the next. Midway in the chain of stations lies the Ohi power house, with a capacity of 44,000 kva, and now just being completed. At this point the effective head is 140-ft., provided by a dam 180-ft. high, built of cyclopean masonry, and a pressure tunnel 3,000-ft. long, yielding a discharge of 4,500 second-feet.

The Ohi equipment comprises four Allis Chalmers-General Electric sets providing 56,000 kva at an 80 per cent. power factor, 66,000 volts, 3 phase, 60 cycles. Two banks of Westinghouse transformers are connected to the 6,600-volt busbars to step the pressure up to 154,000 volts; they are connected delta to star with an open neutral, whilst an extra bank is in reserve. This great proportion of spare plant is characteristic of Japanese construction, and seems to indicate too extreme a conservatism. It will be noticed, however, that the high-pressure neutral point is unearthed, and damage to apparatus cannot fail to be more prevalent for this reason. Japanese practice leans towards undue protection of telephone and telegraph circuits at the expense of power lines, and for this reason the neutral point of the "Y"-connected high-pressure circuits may not be connected directly to earth. There is a tendency among the engineers of the present 154-kv lines to insert a Peterson reactance coil in the earth connection, and it is believed that this device will drain the system in the event of a bad short circuit without giving rise to interference with signal lines; at any rate, the reactance coil will be better than an insulated neutral point, though not so satisfactory as a solid earth connection.

All the power stations on the Kiso River are tied together by means of a 77-kv line, which also taps other sources of power. In the more recent installations of plant, the transformers are wound for 154 kv, and a double-circuit tower line at this voltage connects Suhara (the main switching station for the Kiso sets of plant) with Osaka, a hundred and fifty miles away. This is one of the most substantial and up-to-date high pressure lines recently constructed; the towers are 80-ft. high, weigh about 800-lb. each, and are spaced at an average of 800-ft. apart. Ten unit suspension insulators are used as standard, and each string is suspended from a link to increase the mechanical flexibility and to permit the ultimate increase of voltage by substituting two or three more units. The bulk of the conductor material is 37 strand copper of about 0.40 sq. in. section, but in the mountains, where the critical corona voltage is lower, there is a tendency to use a larger conductor by way of compensation. For this reason quite an appreciable mileage of steel-cored aluminium wire is now being strung on the line. Some sections of the line cross exceedingly rough country, and the use of such reinforced cable makes it possible to string a longer span and so reduce the construction cost.

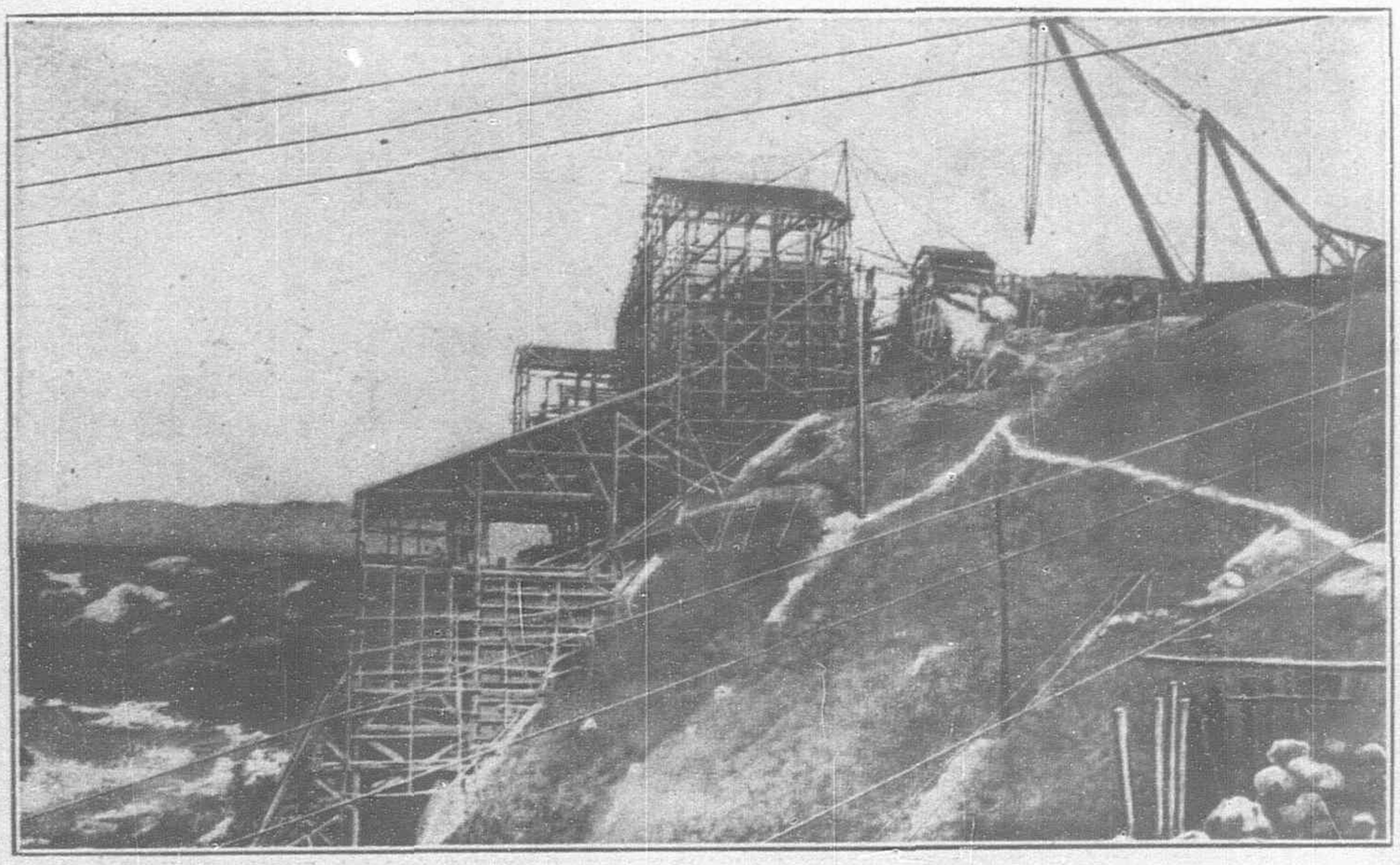


Transmission Line of the Daido Electric Power Company: Tower near Kameyama, midway between Nagoya and Osaka on 154,000 volt, 96 mile Transmission Trunk Line. Elevation at this point, 1,000 feet.

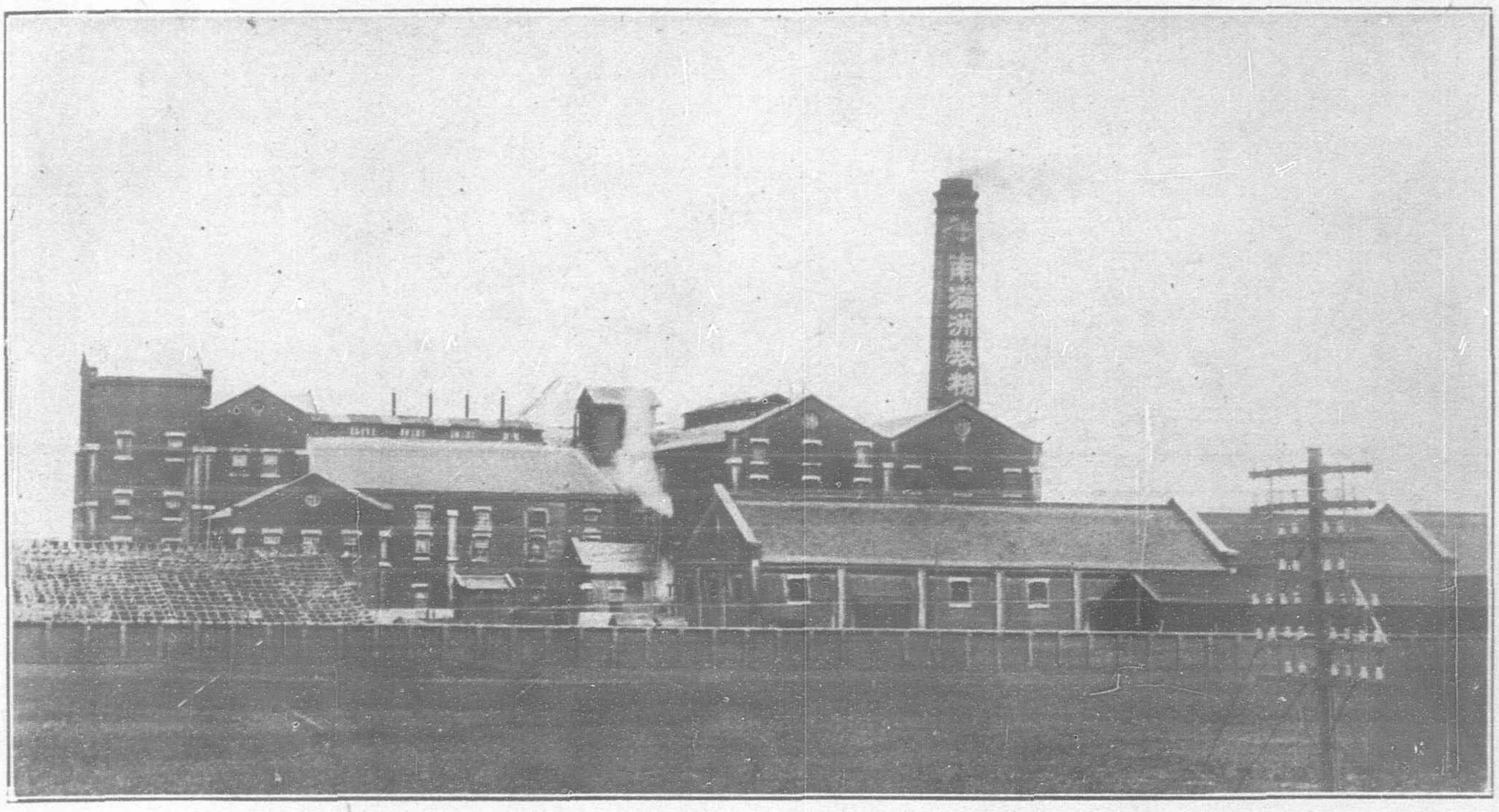
Few localities offer more difficult constructional problems than the average Japanese terrain. The mountains are, on the one hand, high and steep and intersected with deep gorges; on the other hand, the lowlands are given over to rice cultivation, and are almost permanently flooded. Rivers are extremely wide and swift and have unsound banks, while, added to these factors, is the constantly-recurring earthquake which yields sensible tremors at least twice a month. Line construction is therefore costly; concrete anchors are almost universally employed; towers must be built up in sections instead of being hoisted ready assembled; wire can be pulled in but slowly, as it is generally submerged in the swampy ground. For these reasons great credit is due to the Japanese engineers for keeping the construction cost as low as it is.

Near Osaka the 150-mile line terminates in an open-air sub-station, which is one of the greatest in the world, its present capacity is about 140,000 kva, but ultimately it will be able to handle 500,000 kva. There is a 140-kv ring busbar arranged to connect with up to 20 incoming circuits, each with its own switches, transformers, and protective devices. The transformers are wound for 154 kv, but have a tertiary winding for 50 kv for local transmission to the distributing companies' sub-stations, as well as a secondary winding for 11-kv delta connection. There are at present six banks of transformers, each bank approximating 28,000

(Continued on page 283)



Concrete Mixing Plant for Constructing the Ohi Power Plant Dam.



Mukden Beet Sugar Factory of the South Manchuria Sugar Company, Limited

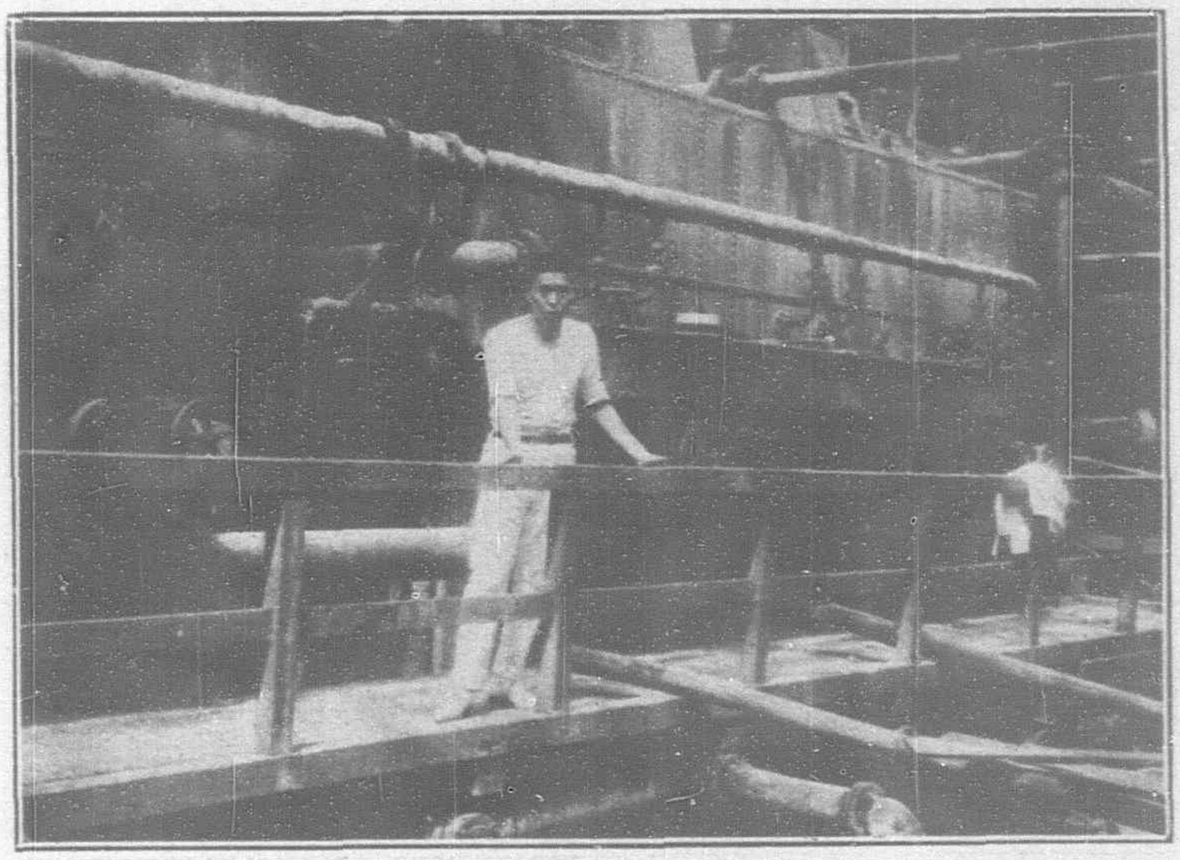
Manchurian Beet Sugar Industry

A REPORT of the Chinese government bureau of economic information says that the soil of certain districts in Manchuria—especially in the vicinity of Mukden and Harbin—is especially suitable for beet growing. Polish merchants were the first to exploit the industry for the production of sugar, and in 1909 established a factory near Ashihho station on the Chinese Eastern Railway in the neighborhood of Harbin. Beginning with a capital of a million roubles, the enterprise prospered after two or three years' depression, and considerable progress was attained by 1919, when the company was adversely affected by the depreciation of the rouble. At that time the capital was a million and a half roubles.

Soon after initiation of the Ashihho factory, several Chinese merchants founded a company which centred its activities on the Makia wharf, Hulan, which is on the Sungari River close to Harbin. Lack of funds, however, necessitated a loan from the government for the purchase of machinery. Still no progress could be made, and in 1912 the provincial governments of Fengtien, Kirin, and Heilungkiang undertook to repay the loan and operate the factory. For a short period the venture gave promise of improvement but bad management eventually caused its failure, work being entirely suspended in 1918. Latterly it mortgaged to a German firm.

Meantime the Japanese had been conducting experiments in the vicinity of Mukden, and in 1918 the preliminary investigations resulted in the formation of the South Manchuria Sugar Manufacturing Company. Its operations included the manufacture of beet sugar, refined sugar, and alcohol. The authorized capital is ten million yen, of which nearly half is paid up. 25,000 *mow* of land from the producing area, and all the plantations are the property of the Chinese farmers in the vicinity. The relation between the firm and the farmers is established by means of a contract, renewable yearly, whereby an undertaking is secured for the cultivation of the beet and the monopolisation of the output by the South Manchuria Company.

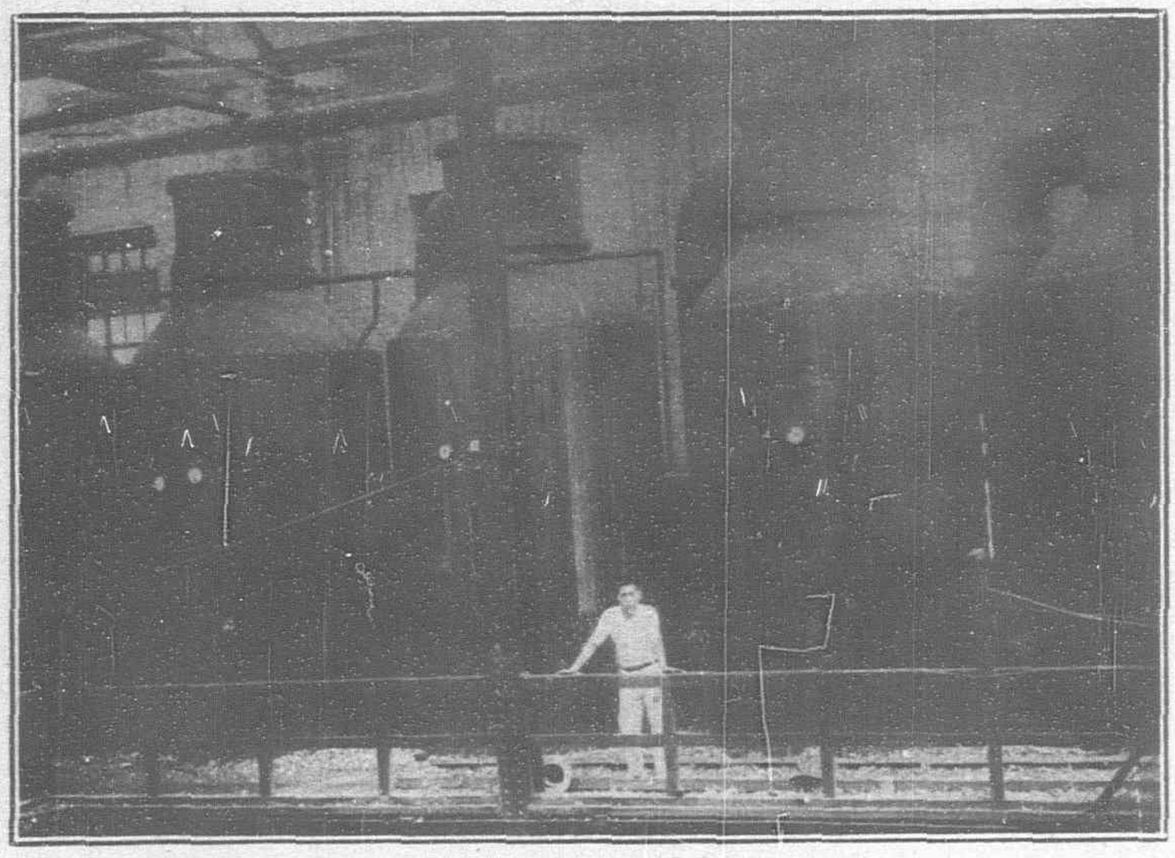
The South Manchuria Company employs Japanese machinery for manufacture of sugar, but the other two companies obtained their plants from Europe, the Hulan factory operating German



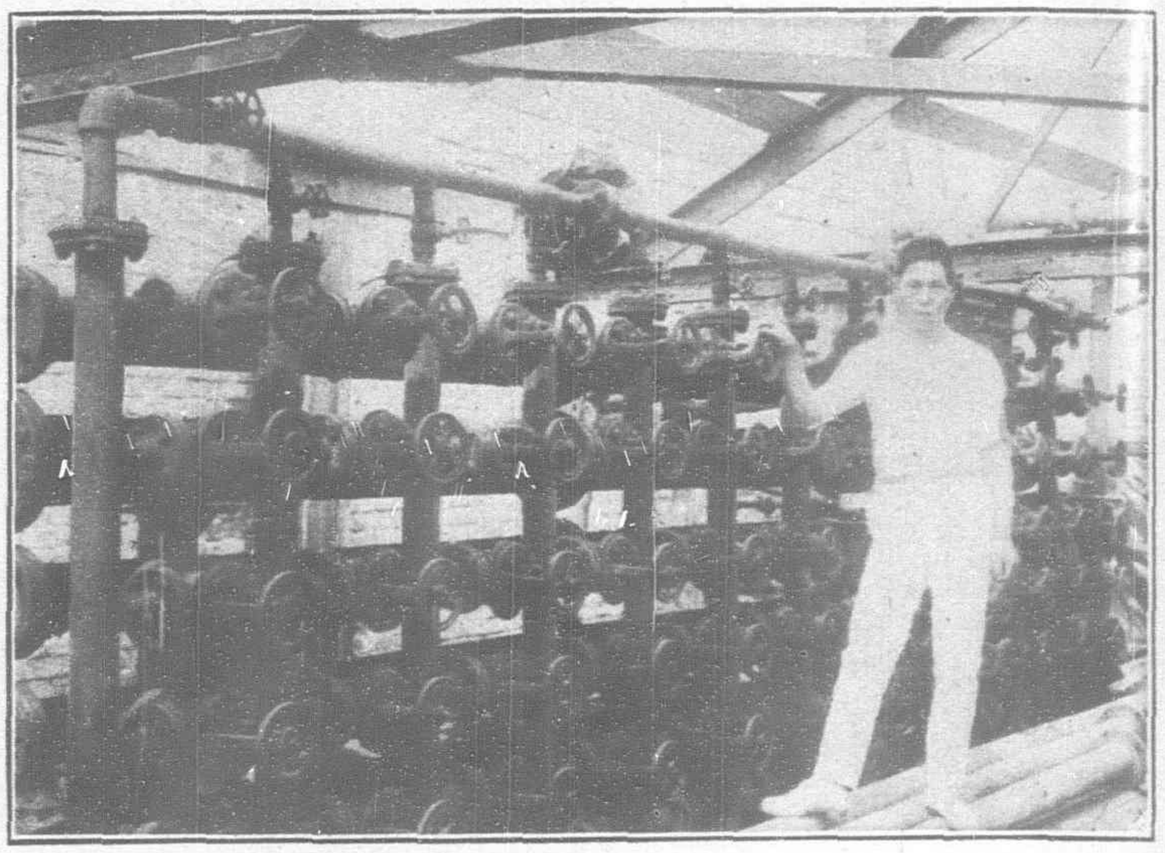
MUKDEN FACTORY OF THE SOUTH MANCHURIA SUGAR CO., LTD.

Diffusion Battery

Carbonization Tanks



Quintuple Effect Evaporator



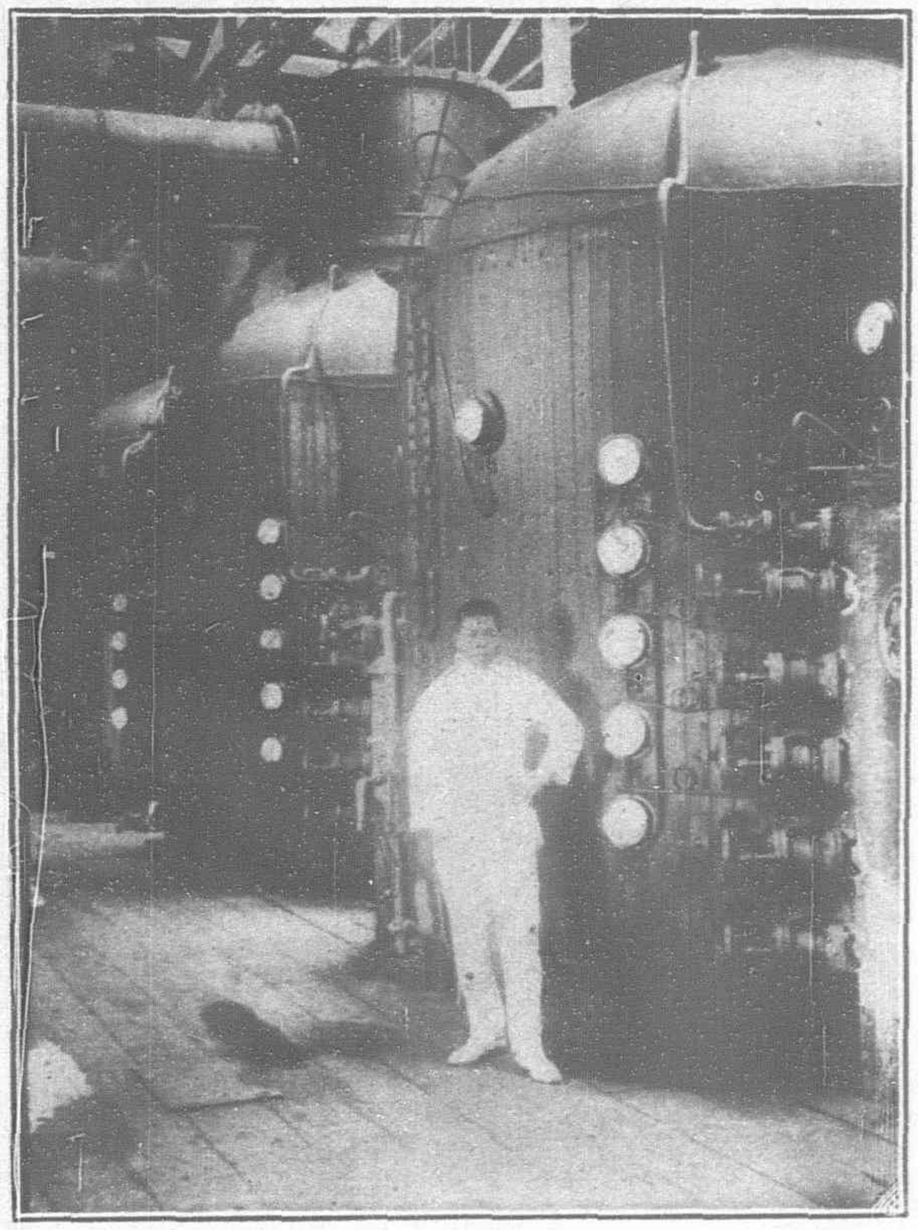
Liquor Pipes and Valves

machinery and the Ashihho factory operating Polish. The Hulan factory has the best equipment and its machines can make 350 tons of beetroot into sugar in twenty-four hours.

The question of disposing of the by-products has been settled by the South Manchuria Company in the establishment of a distillery, but the beetroot refuse, which might be used as fodder for domestic animals, is thrown away as waste. The Ashihho company sells a small proportion of its surplus syrup to a Harbin distillery, but no use can be found for the remainder. There is also a large accumulation of sugar beet refuse.

In 1922 the South Manchuria Sugar Refining Company established a branch factory at Tiehling. From that time sugar beet cultivation in South Manchuria progressed rapidly.

Climate and soil have an important bearing on the growth of sugar beets. Tables prepared by the South Manchuria Railway Experiment Station show the temperature and the rainfall during the growing period are not ideal in South Manchuria. In summer the temperature is too high and the rainfall too heavy to suit sugar beet planters.



Vacuum Pans

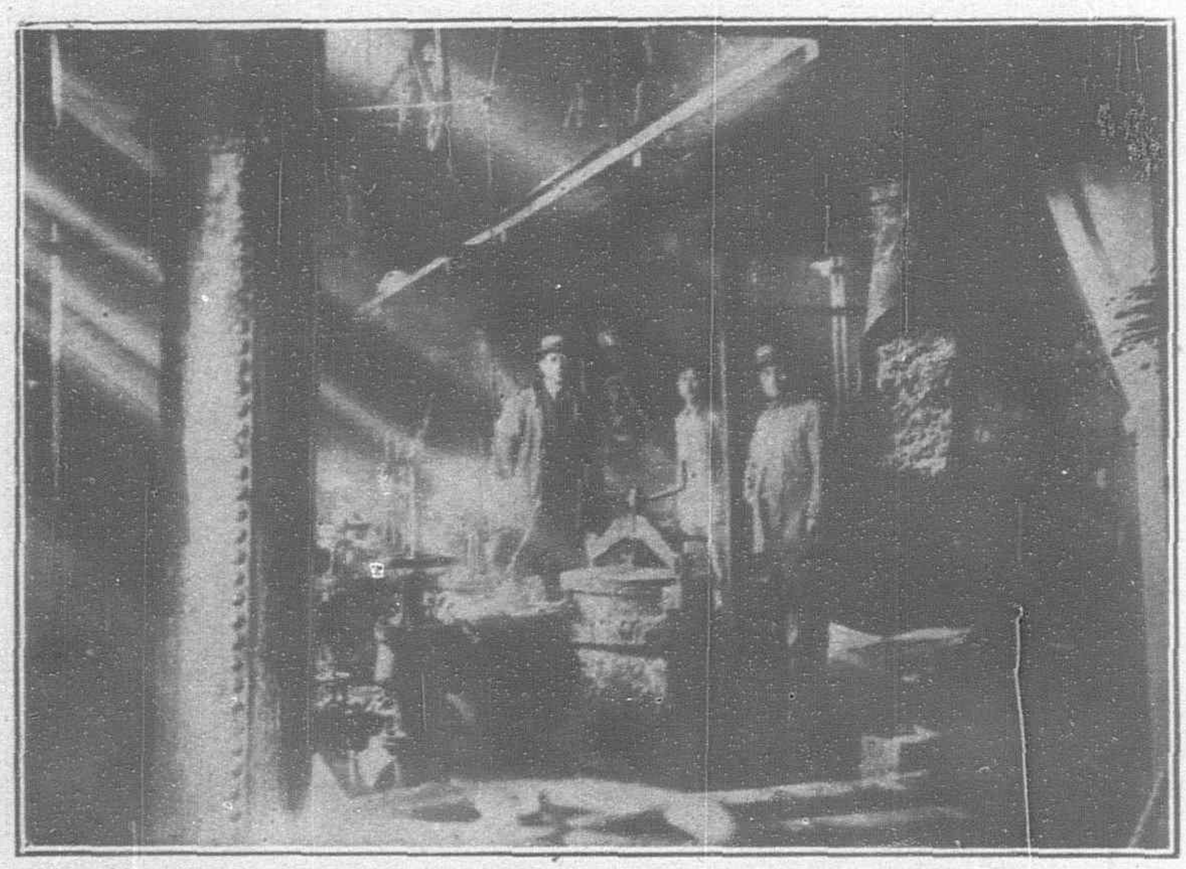
About the middle of autumn, however, there is scarcely any rainfall, there being a period of sunny days and dry weather which makes it a suitable beet climate.

According to Japanese figures, a *mow* of land can produce an average of 78 *kwan* (1 *kwan*=6 catties approximately) of beets containing 15.34 per cent. of sugar. Compared with the beet producing countries of Europe on the basis of one *mow*, the productivity of South Manchuria is surpassed only by Belgium and Germany, as indicated in the following figures, which give the number of *kwan* per *mow*:—

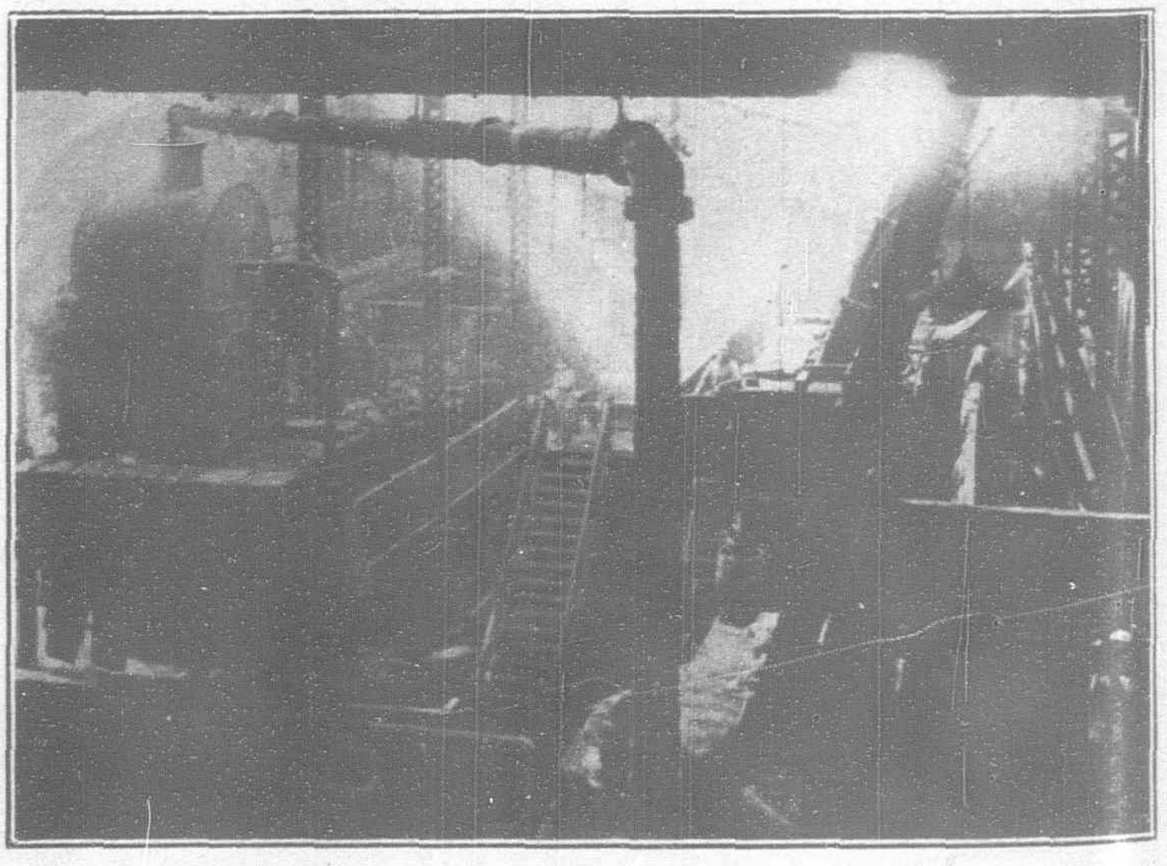
Belgium	Sweden	Austria	Germany
80.26	69.36	64.52	78.96
France	Russia	China	
66.51	37.96	78.00	

Beet Growing is Profitable

The principal agricultural products of Manchuria for a long time have been kaoliang (or millet), walnuts and soya beans. The economic value of beets, however, is greater than that of any of these products. Given the same area of land to each of the four products, the experiment station at Kungchuling in 1916 obtained the following results:—



Charging Diffusion Battery with Beet Chips

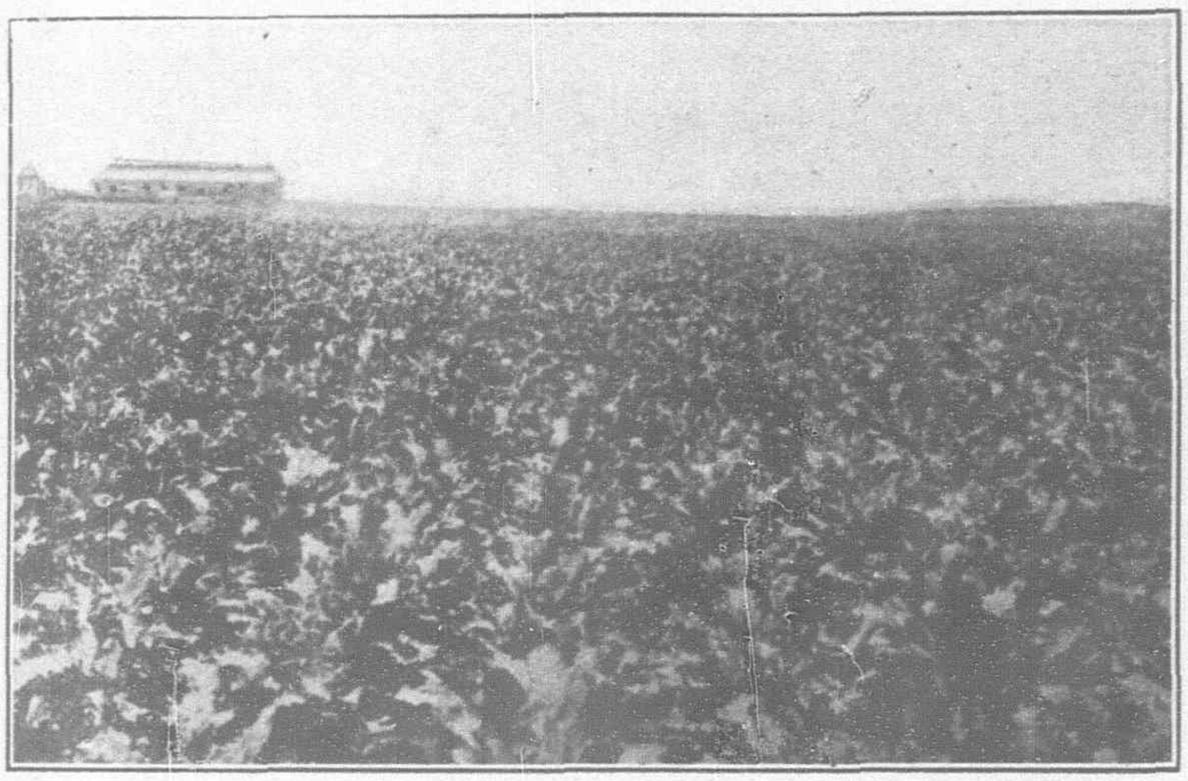


Clarification Tanks

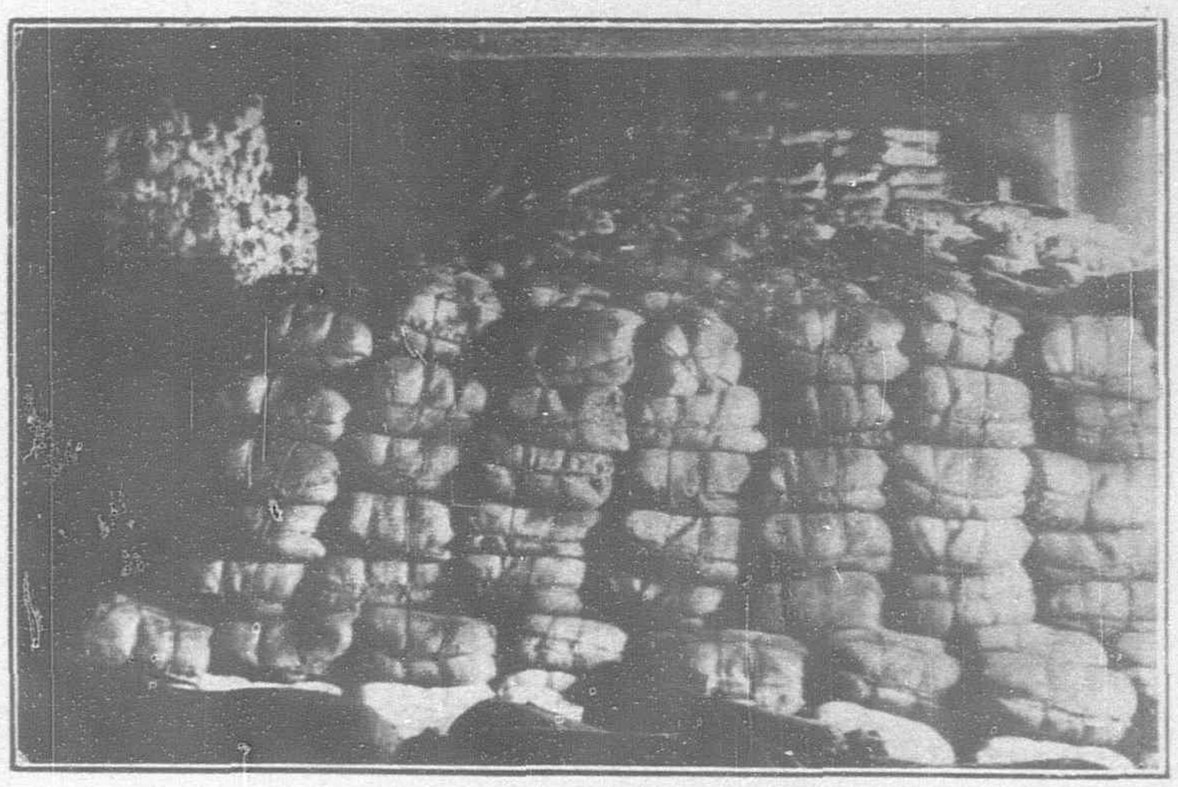
	Soya beans	Millet	Walnuts	Sugar beets
Cost of production ..	$40.392	$45.030	$39.090	$81.540
Net profit	0.769	38.392	39.261	64.323
Receipts	41.161	6.638	0.829	17.217

This was not an absolutely fair test since the production of walnuts in 1916 was impaired by the ravages of parasitic insects, while bad weather adversely affected the soya bean crop. In 1917, when the South Manchuria Sugar Refining Company was first started, the result was not successful. They estimated their production for the first year at 10,000 catties (13,300-lbs.), but the actual harvest was only 5 per cent. of that figure. Next year the production was only 2,500 catties as against an estimated 12,000 catties. However, in recent years farmers have introduced many improvements in cultivation methods and have profited much thereby. The number of *mow* harvested in 1923 reached 30,000 (5,000 acres) as compared with 15,000 to 20,000 *mow* in previous years. The following comparison of prices must not be taken as authoritative, owing to the lack of official figures :—

The price paid by the South Manchuria Sugar Refining Company this year for 1,000 catties of sugar beet is said to be $6 in dimes or about Y.4.89, as against Y.6.80 paid by the sugar refining companies in Hokkaido, Japan, for the same amount. The South Manchuria Sugar Refining Company also benefits by cheaper labor, fuel, etc. In Shantung province the period during which seeds are sown falls generally in the season of scanty rain when destruction by injurious insects has a very serious effect on production. Beet cultivation in Korea is confined more or less to the tableland which is devoted principally to the cultivation of a more important crop, rice. The sugar beet raised in South Manchuria has, therefore, an advantage over that produced in Shantung and Korea in climate and in the position it enjoys as the most profitable crop.



Beets Fields near Mukden



Manchurian Beet Sugar Bagged for Market

Cheaper Than Cane Sugar

The difference is still greater in the cost of production between local beet sugar and cane sugar imported from Formosa. It takes only $10 to produce an amount of beet sugar in South Manchuria which in Formosa would cost the producer a little over $15. Fifteen catties of sugar can be extracted from 100 catties of beets, while the same quantity of cane yields only 10 catties.

The South Manchuria Sugar Refining Company was established in 1916 and is engaged in the cultivation of beets as well as the manufacture of sugar therefrom. The head office and the refinery are located in Mukden with the sugar beet fields lying in the vicinity. The mill consumes about 500 tons of beet daily and the daily output of refined sugar is about 100 tons. The following table gives the number of *mow* of sugar beet under cultivation by the company, the amount of beets harvested and the annual output :—

	1917	1918	1919	1920	1922	1923
Number of *mow*	40,000	42,000	20,000	45,000	60,000	30,000
Production of sugar beet .. (in piculs)	100,000	170,000	300,000	450,000		
Production of sugar	20,400	30,000	50,000			

In addition to the beets from its own land or purchased from the farmers, the South Manchuria Sugar Refining Company obtains raw sugar supplies from Formosa, Java, etc. Since the organization of the company the amount of sugar sold was in 1918, 160,000 piculs ; 1919, 140,000 piculs ; 1920, 50,000 piculs. The reason for the limited sale in 1920 was the decreasing demand chiefly caused by the general business slump.

Though for the present, beet sugar is behind imported sugar in quantity and value, the former has the advantage of nearness to the source of the raw material. When the raising of the sugar beet has become a full-fledged industry, it is reasonable to expect an excess of exports over imports.

The facilities for experiment and investigation in North Manchuria are at present limited. Furthermore, the climate is colder than in the South. The industry in North Manchuria had its beginning sometime between the period of development by Russians and the Russo-Japanese war, and is at present confined to two refineries located at Ashihho and Hulan.

According to the reports of the Chinese maritime customs, the amount of sugar imported into South Manchuria from 1911 to 1920 was on the average 500,000 piculs annually. Native production of beet sugar from 1918-1920, on the other hand, was only 33,000 piculs and that in North Manchuria between 1910 and 1915, 36,000 piculs a year. Owing to the small volume of production the data for Hulan is not available. It is, however, estimated at 50,000 poods or 13,650 piculs. The total production of beet sugar by all the companies is estimated at 83,009 piculs, which is only equivalent to one-sixth of the amount imported. Therefore imported sugar still occupies a more important position in the sugar trade of Manchuria. But the geographic and climatic conditions in Manchuria are such that it will be able to compete in the future with sugar that comes from foreign countries.

Ohi Hydro-Electric Plant

(Continued from page 280).

kva ; six synchronous condensers are also provided, each of 15,000 kva.

Although most of the outgoing lines from this station are at 50 kv, there is also an outgoing 11-kv tie line, which takes the shape of a three-core paper-lead cable, steel-tape armored and laid in concrete troughs. This high-voltage cable is one of the few items in the construction work which is entirely the product of the Orient. It was manufactured in a Japanese mill, and is entirely representative of the best cable-makers' practice ; similar three-cored cables to withstand 22 kv are manufactured in the same factory.

The Daido Electric Power Co., by wise consolidation, has grown out of a series of small power companies to an organization of boundless possibilities, because within its territory some 300 miles of main-line railway is operated. All this mileage is fast being converted to electrical operation, and, when completed, a constant and assured load up to 200,000 kw will be available for the power company.

Largest Self-Propelled Floating Crane in the World

The 350-Ton Crane at the Mitsubishi Shipyards in Japan

Built by Cowans, Sheldon & Company, Ltd., Carlisle

AMONG the large floating cranes which have been constructed during recent years, a noteworthy example was that which was built for the United States navy department, on to the hull of an old battleship the Kearsarge, and designed to lift 250 tons at a radius of 101-ft. The hull of the battleship was before its conversion 72-ft. 2½-in. in width, with a total displacement of 11,525 tons. Bulges were added and the width increased to 92-ft., the removal of superstructure and machinery then reducing the displacement to 10,350 tons. Floating cranes of greater capacity have, however, been constructed by Cowans, Sheldon & Co., Limited, of Carlisle, and one of a considerably larger type was recently sent out to Japan. It was designed to lift a working load of 350 tons at 100-ft. radius, or 300 tons at 121-ft. radius. It is of interest to compare the characteristics of this crane with those of a previous crane supplied to the British admiralty in 1915 by the same builders, and with those of the American Kearsarge crane. In making this comparison, it is assumed that the working load of the American crane is given in the American short tons of 2,000-lb. The following are the leading particulars of the three cranes :—

Crane type.	Net load in British tons	Radius in feet.	Lifting moment. foot-tons.
250-ton Kearsarge ..	223.2	101	22,543
250-ton Cowans, Sheldon	250	100	25,000
350-ton Cowans, Sheldon	350	100	35,000
	300	121	36,300

These figures show that the American crane has a less capacity than had the British crane, which was designed and supplied a number of years before it, and that the 350-ton crane, which forms the subject of the present article, is over 37 per cent. larger as regards its lifting moment. Again, whilst the American crane was built on a battleship hull, which was, of course, very helpful from the point of view of stability, the British crane was—in view of its being designed to meet world-wide competition—placed on as small a pontoon as possible. The accompanying drawing and illustration give some idea of the size of the pontoon in relation to the superstructure. It may be noted that the pontoon is 270-ft. long and 91-ft. wide, with a draught of 10-ft. The comparatively small size of the pontoon confers a greater useful crane radius beyond the ship's side, and it will be seen from the illustration of the completed crane that a load can be lifted over the end of the pontoon as well as at the sides. This feature is very useful when working in narrow and congested waterways, particularly when such operations as the raising of lock gates, etc., have to be undertaken.

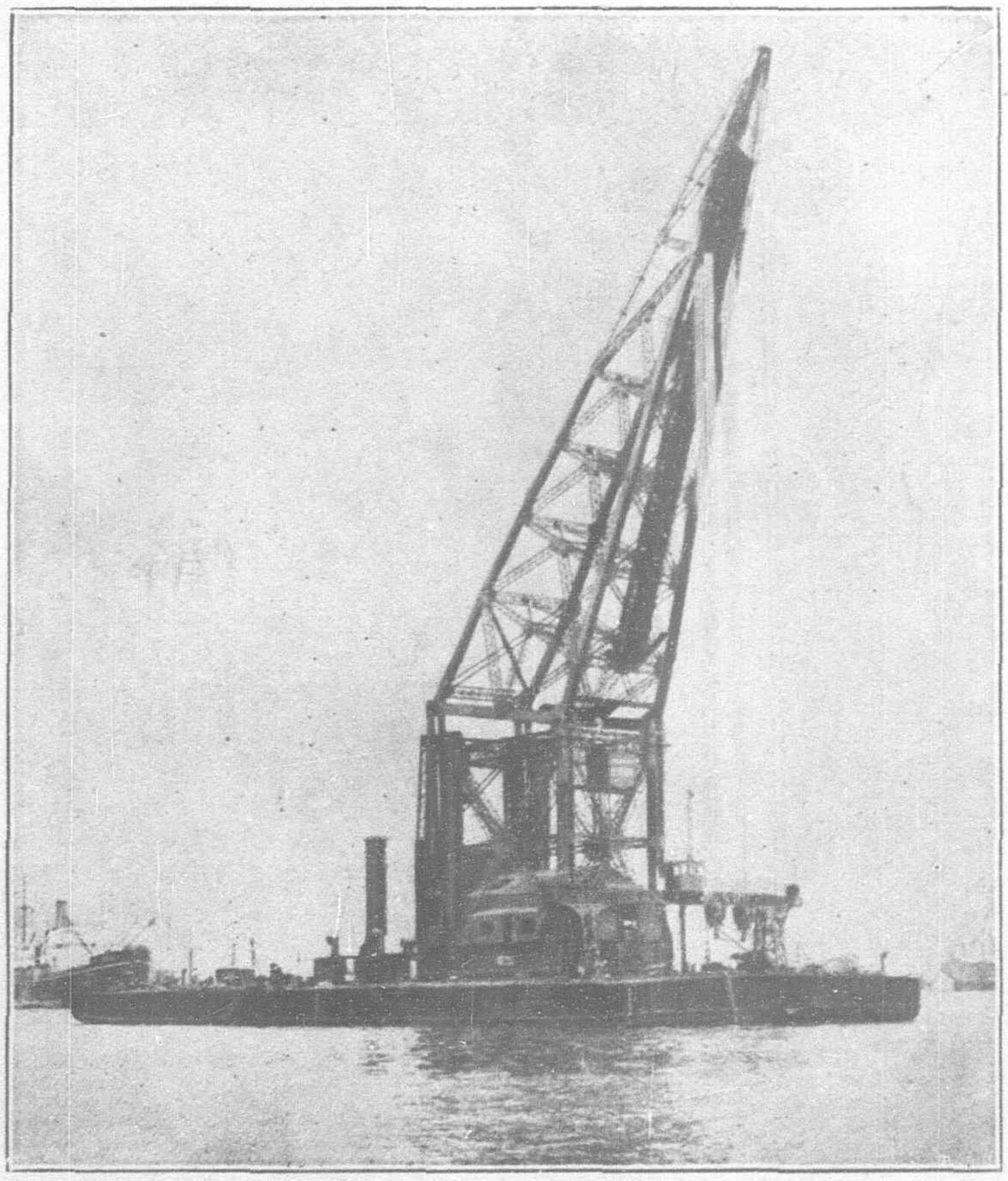
The crane and its machinery was built to the order of Mitsubishi Shoji Kaisha. It was partially erected in the makers' works at Carlisle, and was afterwards re-erected in Japan under supervision of one of the builders' engineers. The pontoon and the propelling machinery were constructed by Mitsubishi Shoji Kaisha, Limited, to drawings prepared for Cowans, Sheldon, Limited, by Sir W. G. Armstrong, Whitworth & Co., Limited. Before giving an account of the interesting work of erecting such a large structure on a floating base, some particulars of the design of the crane and its operating mechanism may be given.

General Particulars

The crane is constructed to lift and revolve through a complete circle with loads up to 350 tons at 100-ft. radius or 300 tons at 121-ft. radius, and is capable of lifting either of those loads through a vertical distance of 140-ft. The main loads are lifted on two independent blocks of 175 tons capacity each, and the operating machinery is so arranged that these blocks may be used either independently or coupled together, as desired. An auxiliary purchase of 50 tons capacity is provided at the end of the jib, at a distance of about 40-ft. in front of the main purchase, and this block is arranged for a vertical lift of 200-ft. There is also an additional purchase of 50 tons capacity carried on a trolley arranged to travel along the underside of the jib to a sufficient extent to move the load through a distance of about 75-ft., measured horizontally. This feature enables the crane to deal with comparatively small loads at a quick speed without the necessity of using the derricking motion.

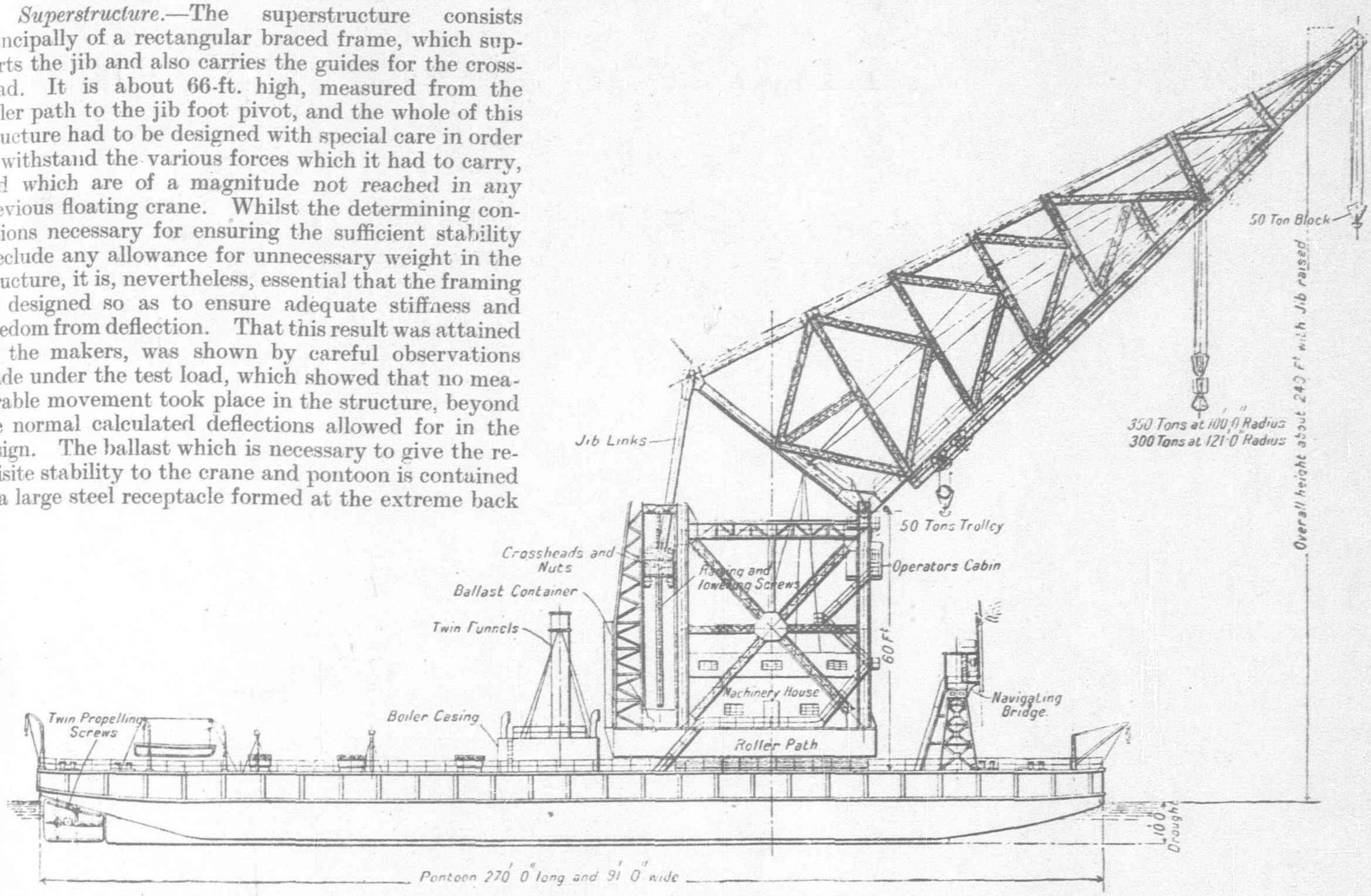
The jib is designed to be capable of derricking in from the maximum radius of 121-ft. to a minimum radius of 50-ft., and when in this condition—as illustrated the overall height to the top of the crane is approximately 240-ft. It will be seen that the entire crane is mounted on a roller path, which has a diameter of about 50-ft., and is furnished with specially arranged machinery, enabling the crane to be revolved with its load through a complete circle in either direction. Each individual motion is operated by an independent set of double cylinder engines fitted with link motion reversing gear, and there are altogether nine such sets of engines on the crane.

The raising and lowering of the jib is effected by means of two large steel screws, 49-ft. long and 14-in. in diameter, situated at the back of the crane, which are driven from the engines through a train of gearing and arranged to engage with nuts housed in the crosshead. The crosshead is 34-ft. wide, and to it the links from the jib are attached. The load on the screws for this crane was exceptionally heavy, and very careful consideration was given by the makers to the provision of adequate bearing surfaces and an efficient system of lubrication. It is interesting to learn that this motion worked with complete satisfaction throughout the extensive trials to which the crane was subjected on its completion.



The completed 350-ton Crane erected on a pontoon, previous to shipment for Japan

Superstructure.—The superstructure consists principally of a rectangular braced frame, which supports the jib and also carries the guides for the crosshead. It is about 66-ft. high, measured from the roller path to the jib foot pivot, and the whole of this structure had to be designed with special care in order to withstand the various forces which it had to carry, and which are of a magnitude not reached in any previous floating crane. Whilst the determining conditions necessary for ensuring the sufficient stability preclude any allowance for unnecessary weight in the structure, it is, nevertheless, essential that the framing be designed so as to ensure adequate stiffness and freedom from deflection. That this result was attained by the makers, was shown by careful observations made under the test load, which showed that no measurable movement took place in the structure, beyond the normal calculated deflections allowed for in the design. The ballast which is necessary to give the requisite stability to the crane and pontoon is contained in a large steel receptacle formed at the extreme back



Arrangement of Cowans, Sheldon 350-ton Floating Crane on pontoon designed by Sir W. G. Armstrong, Whitworth & Co., Ltd.

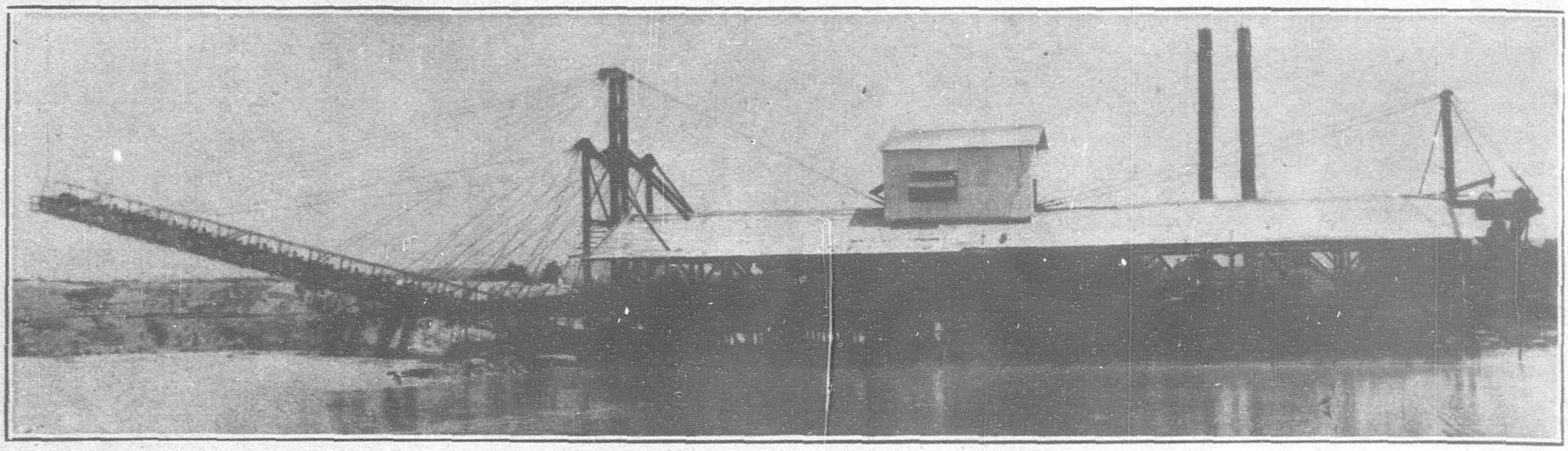
end of the crane and attached to the superstructure. It may be noted also that the pontoon was made of such a size that any moving or water ballast which would have to be adjusted at the discretion of the operator was rendered entirely unnecessary.

Brakes and Controls.—The two main lifting gears and both the auxiliary lifting gears are each provided with specially designed hydraulic brakes to sustain and control the lowering of the loads, and these brakes are strong enough to enable a desired load to be sustained with safety or lowered with precision at any speed between the maximum speed and the lowest possible creeping speed which may be used in practical working. The whole of the motions are controlled by one operator, whose cabin is situated immediately beneath the jib foot, from which a clear view of the load and the site over which the crane is working is obtained. The various motions are operated by a special system of control gear which has been successfully developed by the makers, and which they state enables steam cranes of the type we are describing to be worked with the same ease and precision as that obtained when electric power is used. The steam for operating the different engines is taken from the ship's boilers through a rotary connection at the crane centre, and the exhaust is in each case returned in a similar manner to an independent condenser, which is arranged to work in conjunction with either the crane or propelling machinery.

The Pontoon and Deck Auxiliaries.—The pontoon, illustrated below, is 270-ft. long by 92-ft. wide, and it has a draught of approximately 10-ft. A large area of the deck behind the crane is provided with seating timbers, and otherwise arranged so that it is possible to carry a deck load of about 700 tons. All the propelling machinery is placed amidships, and it consists of twin screw compound engines, which are supplied with steam from two single-ended boilers at a pressure of 150-lb. per square inch. The hull of the vessel was constructed entirely of steel, and it is divided into a series of water-tight compartments by means of transverse and longitudinal bulkheads. The understructure supporting the crane was specially designed to carry the enormous revolving load with practically no deflection, a feature which is essential in order to ensure accurate bearing on the roller path in all positions. In connection with this, it may be remarked that the entire roller pathway was accurately machined by a special machine tool which the makers have constructed for this purpose, and which has given highly satisfactory results on this and other large cranes which the firm has made. The deck equipment comprises a steam windlass with warping ends, four steam capstans, and complete steam and hand steering gear, together with the usual complement of skylights, scuttles, bollards, fairleads, davits, lifeboats, and all other auxiliaries necessary for a sea-going vessel. As will be seen from the accompanying drawing, the navigation of the ship is controlled from a steel bridge extending the full width of the deck, which is situated immediately in front of the crane base. Double timber fenders, fitted with vertical rubbing pieces and placed at the sides and ends, protect the hull in the usual way.

Erection and Testing

As may be well imagined, the enormous size of the structure and the weight of various finished parts was such as to demand a very carefully planned scheme of erection. The difficulties and dangers were enhanced by the fact that assembly had to take place on a floating base, which from time to time had to be careened to a sufficient angle to enable parts to be joined together. We have already mentioned that the main parts of the crane were assembled at Carlisle, and were shipped in pieces of appropriate size for erection. The work on site was facilitated by the service of another floating crane, which had previously been supplied by the same makers. There were six typical stages in the work of erecting the jib, which weighed over 300 tons. The first operation was to lift the lower section from the quayside and place it in position for securing to the superstructure. This operation, was completed in the short space of six hours. Then followed the lifting of the top section, which proved a delicate and difficult task, especially in the final stages just before it was attached to the lower section. This work occupied only four hours, which bears testimony to the extreme accuracy with which the various component parts were manufactured and prepared for placing together. After its completion, the crane was subjected to an extensive series of trials, and that everything was shown to be in full accordance with the specified requirements, and that the trials were carried out to the entire satisfaction of all concerned.—*The Engineer.*



Type of Modern Tin Dredge at Work near Ipoh, F.M.S.

Tin Dredging in Malaya

Paper Read by A. J. Kelman Before the Engineering Association of Malaya

BEFORE dealing with the main subject of my paper, I shall try to describe to you a little of the history of bucket dredging for the recovery of minerals. As you are all aware dredging for gold was first started in New Zealand, the first dredge starting in the year 1865, on the Clutha River. This early type of dredge was what is known as a Spoon Dredge, the digging apparatus consisting of a piece of iron bent in the shape of a horseshoe, and attached to which was a bullock hide, this was dropped in the bed of the river and dragged along by means of a hand winch ; the material scooped into the hide was than hauled on board and washed in a small sluice box.

After the Spoon Dredge came the steam driven dredge, the first of which kind was built in the year 1882, but afterwards was converted to what was called a current wheel dredge. Attached to the pontoon of this dredge and driven by the current of the river were two side paddle wheels to which were fastened sheet iron buckets which lifted the water for washing the material ; from these wheels power was transmitted to drive the buckets. The great disadvantage of this type of dredge was, that to gain sufficient power to drive the buckets it was necessary to keep out in the current of the river, it being impossible to work in near the banks.

As years went on and with the addition of later improvements steam dredges were built, gradually increasing in size until (I think I am right in saying that the largest dredge built in New Zealand was about 7 cubic feet bucket of the open connected type).

The American Dredge

Recently an American dredge of a much heavier type and having a larger capacity has been installed on the west coast of New Zealand, where it is proving very successful in its operation.

In my opinion a great factor in bringing dredges up to the present state of efficiency has been the progress made by the American dredge builders, who have succeeded in bringing to the dredging industry an entirely different type of dredge from that which has been operating in New Zealand.

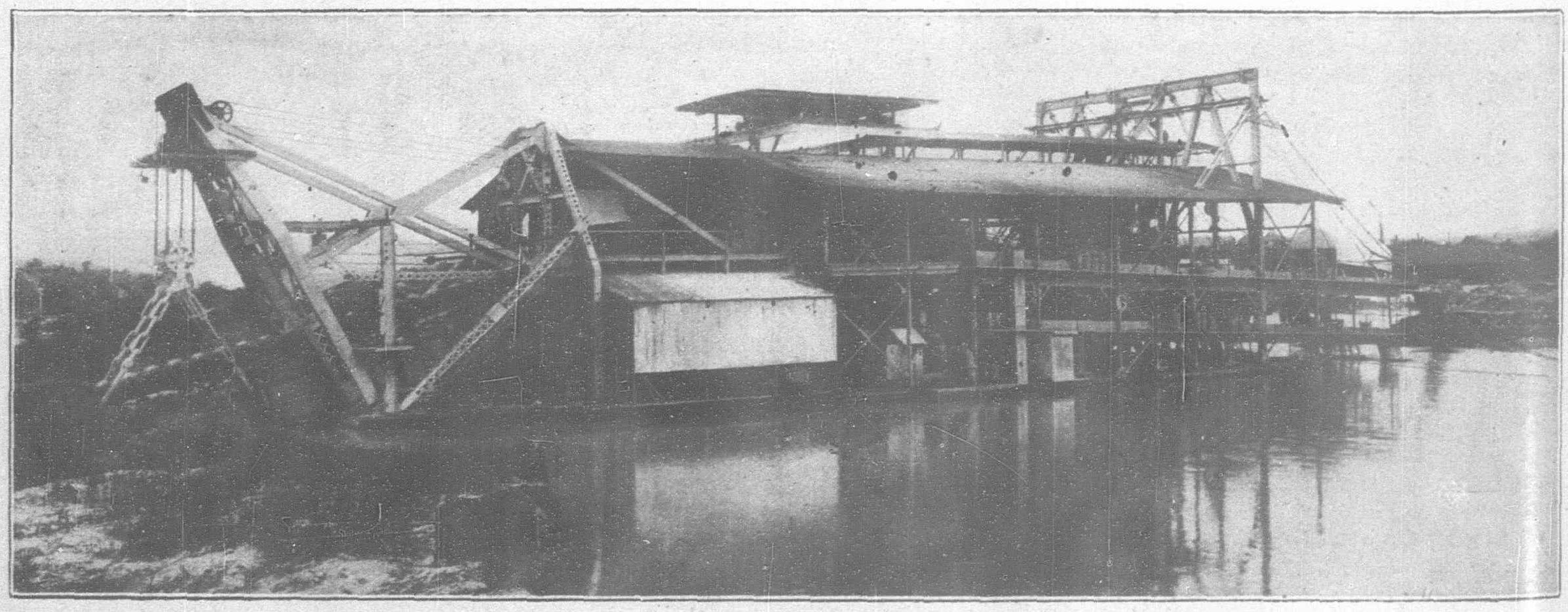
The American dredge is usually electrically driven and of the close connected type, the buckets made either of manganese or nickel chrome steel, with nickel chrome pins. They are also equipped with a spud as it has been found that the size of head line required to hold these dredges up to the face when working heavy gold bearing wash, being too cumbersome to handle.

The spud is a long steel casing with a heavy steel point ; this is supported at the stern of the dredge and lowered to the bottom, and when the dredge is working, pivots on this point.

The length and size of these spuds depends on the depth of the ground to be worked and the size of the dredge.

The aim of the American designer has been to produce a dredge with increasingly large capacities as it is found that, as the richer areas have been worked out, it is necessary to increase the capacity of their dredges to enable them to successfully treat the lower grade areas, and a good many of their machines have very much larger capacities than anything we have in this country.

Having thus briefly dealt with gold dredging in New Zea-



American Built Tin Dredge on the Tronoh Properties of the Gold Mining Company

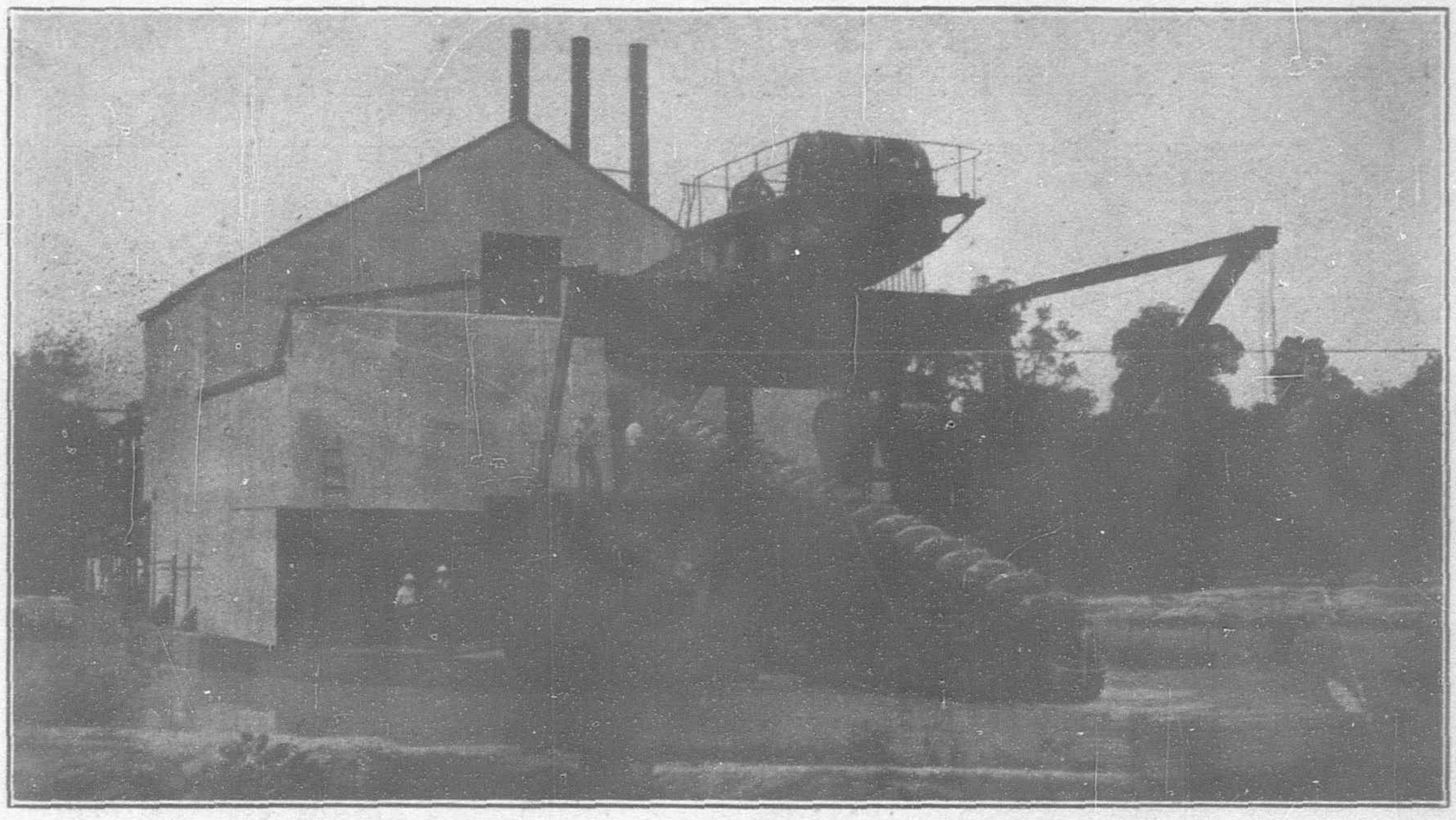
land and America, we will now consider the question of dredging for tin in this country.

As you are aware mining for tin in the Federated Malay States is a very old industry, tin having been mined by the Chinese for approximately 200 years.

The First Dredge in the F. M. S.

The first dredge to work for tin in the F.M.S. was a small machine which started working at Tronoh in November 1912; this machine was built principally to work tailings, but did not prove a success. The Malayan Tin No. 1 which started working in January 1913, was the first machine to work successfully in this country.

This dredge originally had a 12-in. gravel pump to enable the ground to be dug from between the uneven limestone pinnacles but the pump was eventually discarded.



Australian Built Dredge on the Properties of the Sixth Taiping Tin Dredging Co., Ltd.

It was soon found that this dredge had not sufficient table area, it was also found that the stacker was not needed in this class of ground, and by discarding the stacker the dredge had sufficient flotation to enable extra tables to be installed. On our other dredges provision was made for extra tables and I think I am right in saying that the area of the tables on our dredges is greater than on most dredges in this country, but it is found that we still have insufficient for this class of ground, but to increase the table area, it would be necessary to increase the size of the pontoon in order to give sufficient flotation for the extra weight the dredge would then have to carry.

The size of a dredge is usually governed by the nature of the material to be dug and the depth to bedrock. With ground composed of cemented material buckets of the largest size should not be used, but where large boulders are encountered the larger buckets are better for ease in handling.

When shallow ground is to be worked there is the difficulty of floating a larger dredge as they usually draw from 10 to 12 feet of water.

In designing a dredge for any particular area the nature of the ground should be very carefully studied and the machine designed to suit that particular class of ground as a dredge suitable for one area may not be suitable for another, where there is a different class of ground to be treated.

The difference between tin and gold dredging is principally in the saving, tin being much lighter than gold and being much more difficult to save.

The method we have at present in use, viz., the concentrating of the tin in launders gives a loss from 10 to 15 per cent. and in this method there is considerable room for improvement.

Mr. Newsom's Experiments

Mr. Newsom, of the Yukon Gold Company, has been experimenting with a combination of classifiers and jigs and has perfected a concentrating system which in my opinion is a great improvement on the present method. I am of the opinion that before long we shall see most of the dredges equipped with this type of concentrator.

Mr. Newsom claims that the loss in concentrating by his system is round about 2 per cent. as against our present loss of from 10 to 15 per cent. Not only does this system increase our saving but it would make our present dredges capable of treating the maximum amount of material they can dig.

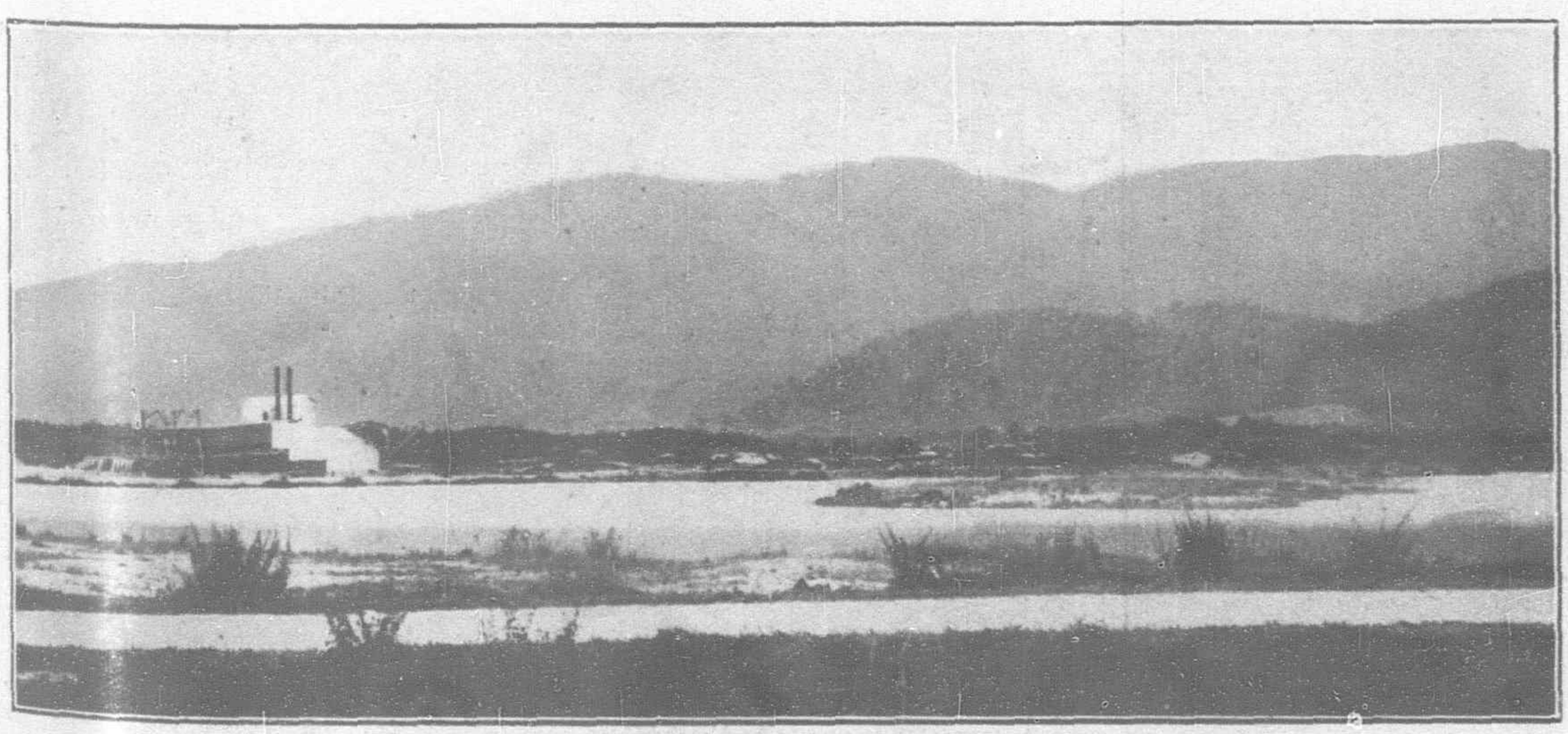
Most of the dredges in this country are capable of digging considerably more than what the tables can handle and I estimate that with the installation of this type of classifiers and jigs, a number of these machines would be able to increase their yardages by approximately 25 per cent.; the cost of running the dredge to treat the increased yardage being very little more than our present cost.

On some of the dredges already working it would be impossible to fit on this appliance without redesigning the whole of the superstructure.

There are difficulties in dredging for tin in this country, which is not usually found in gold dredging areas, that is desintegrating the tin bearing clays found in some areas and the method we have in use namely the revolving screen is not very efficient. In some cases high speed puddlers have been installed with a certain amount of success, but I consider there is still room for improvement in this respect. Another difficulty is the limestone bottom, and a number of dredges in this country are working on areas with this class of bedrock. In working on these areas a certain amount of material must be left behind depending on the irregularity of the limestone.

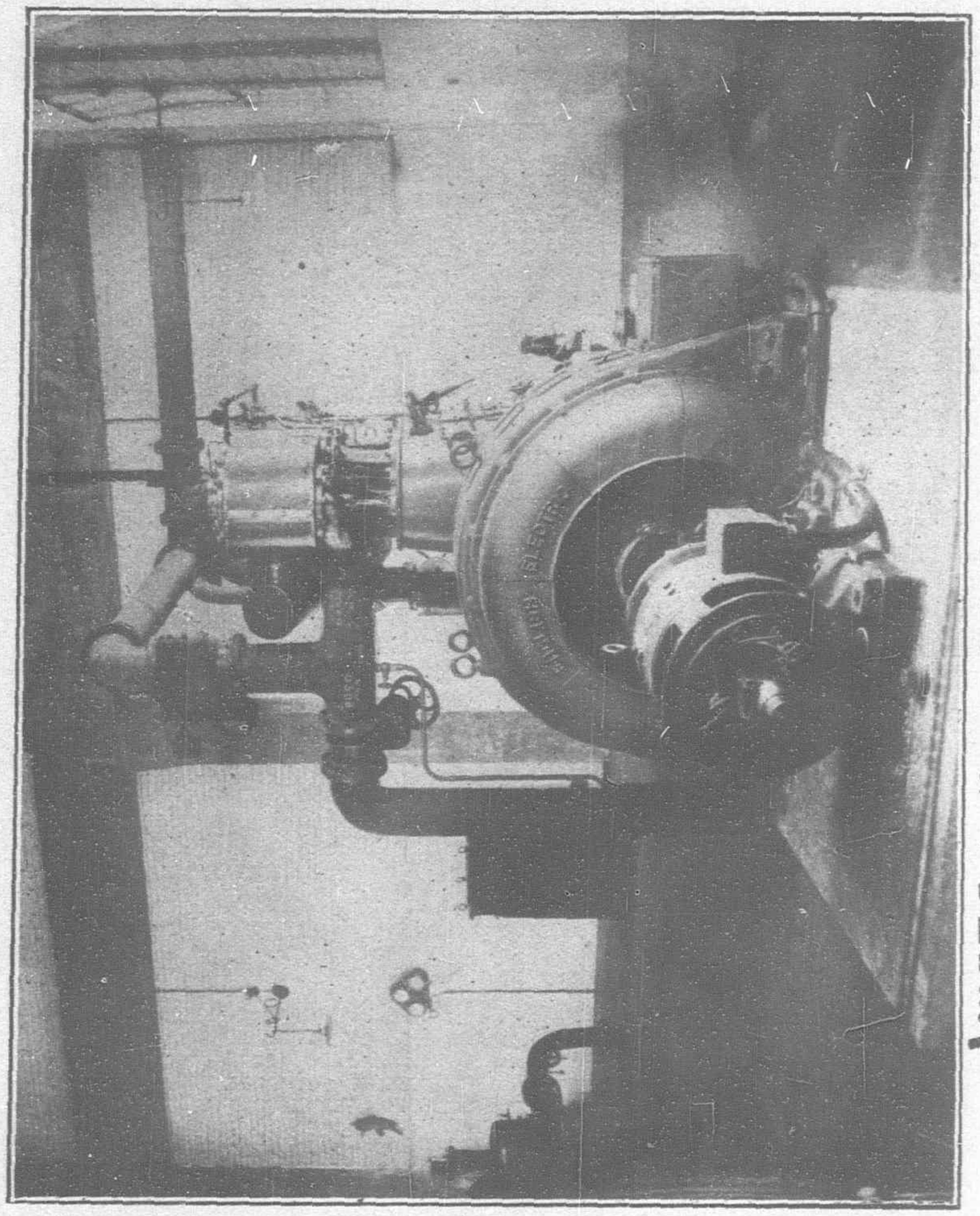
In estimating the amount of material that can be dug by a bucket dredge this must be taken into account and an allowance made accordingly.

Working on this kind of bedrock also tends to decrease the yardage treated, as the winchman must be very careful when working between the pinnacles, and is not able to keep full buckets the whole time. Sunken timber is another difficulty we come up against in the swampy areas, and one which causes a good deal of lost time, seriously affecting the monthly yardages in some case.

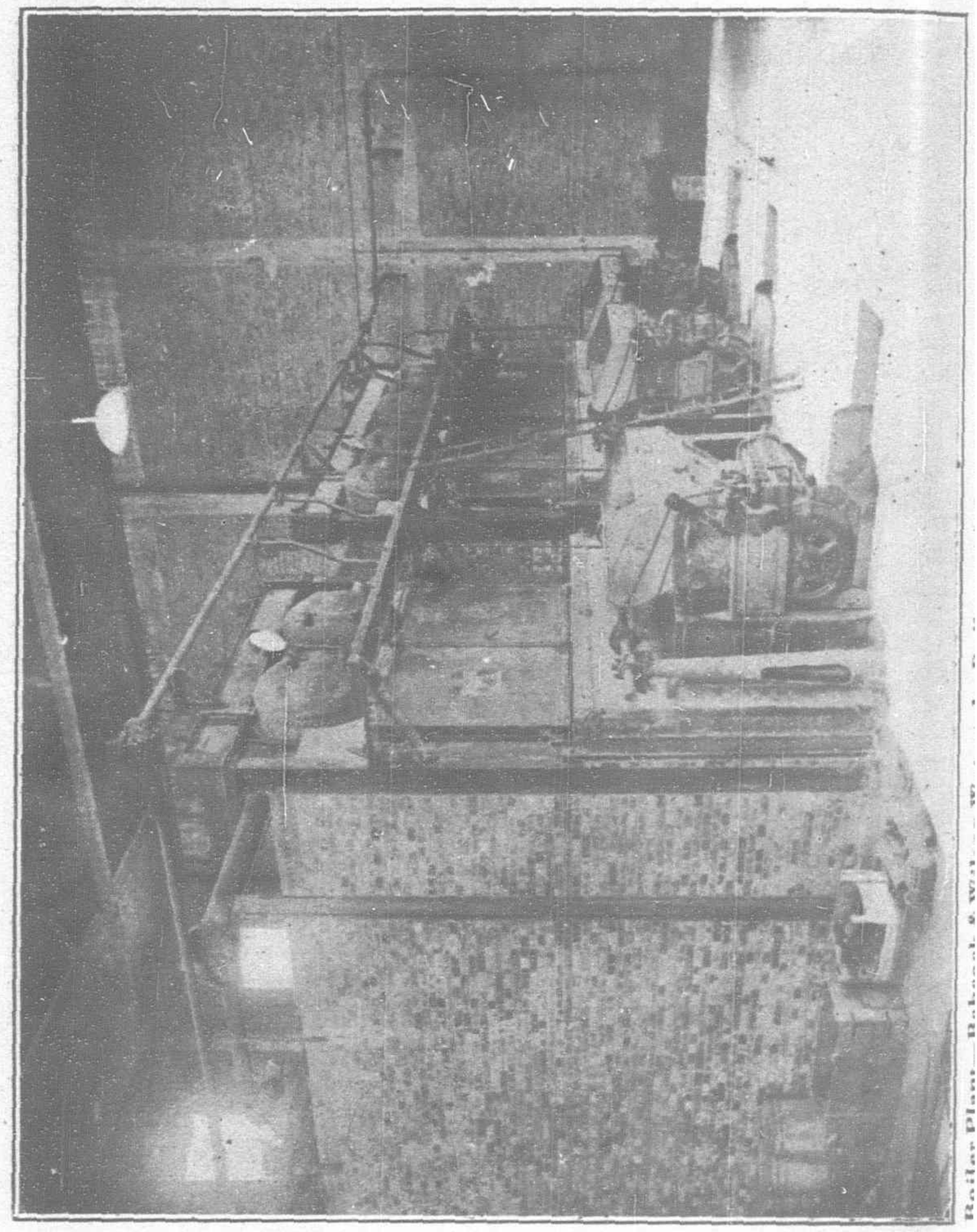


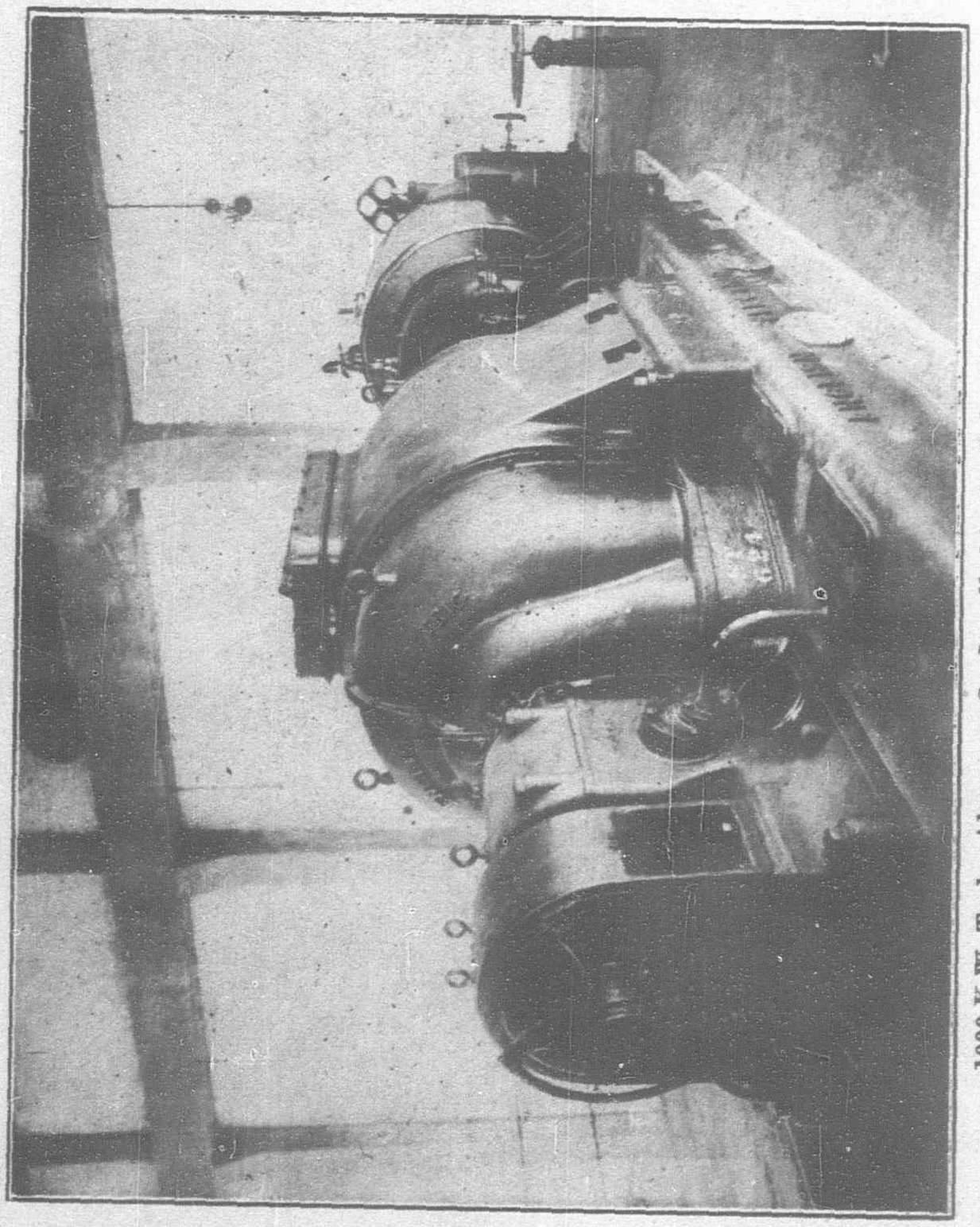
Bucket Dredge at Taiping

AN ENGLISH ELECTRIC TURBO-GENERATING PLANT FOR THE TIENTSIN-PUKOW RAILWAY INSTALLED BY THE JARDINE ENGINEERING CORPORATION

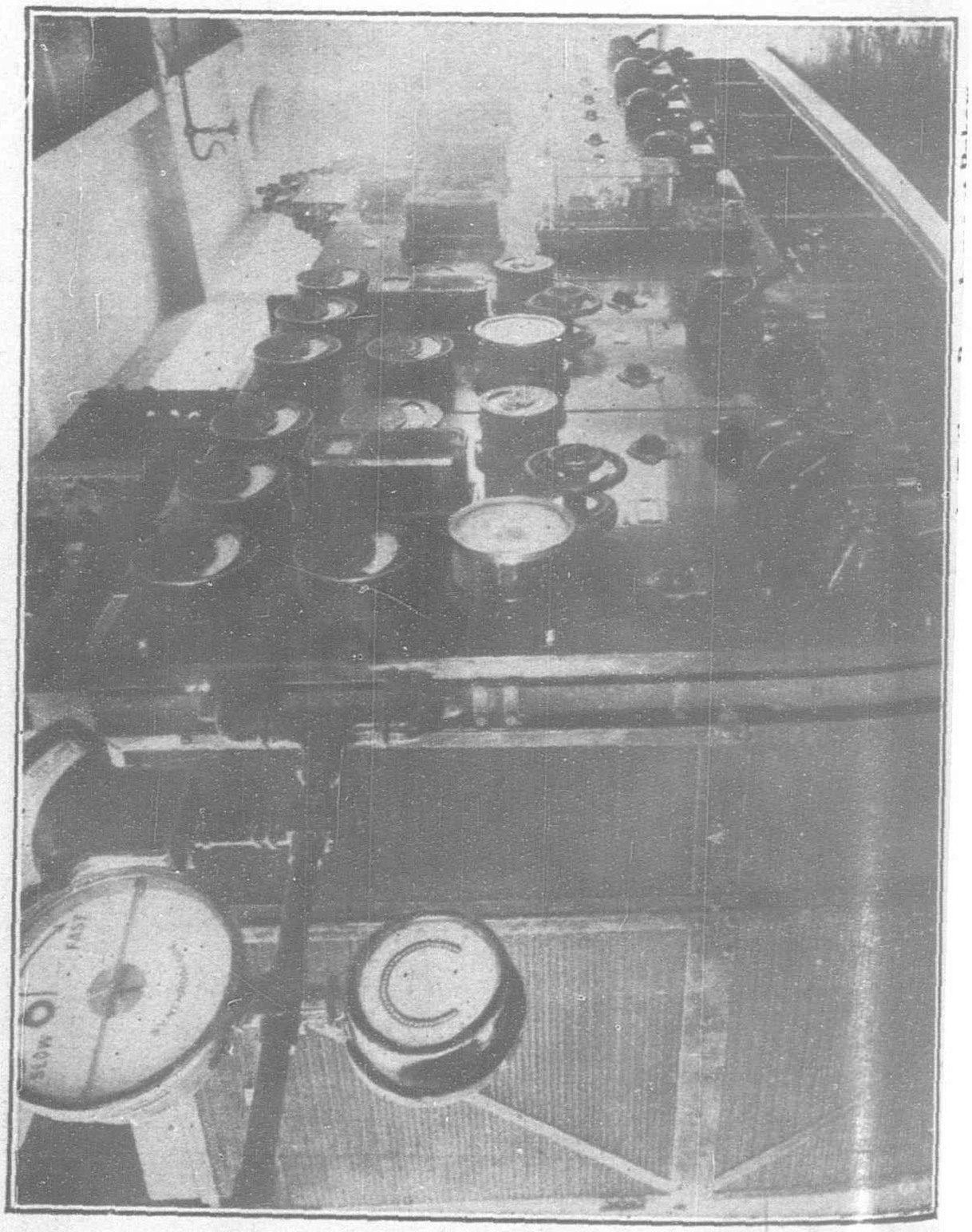


200 K.W. Engine Alternator Set for Carrying the Lighting Load





1000 K.W. Turbo Alternator Set Installed in the Pukow Powerhouse



The Tientsin-Pukow Railway

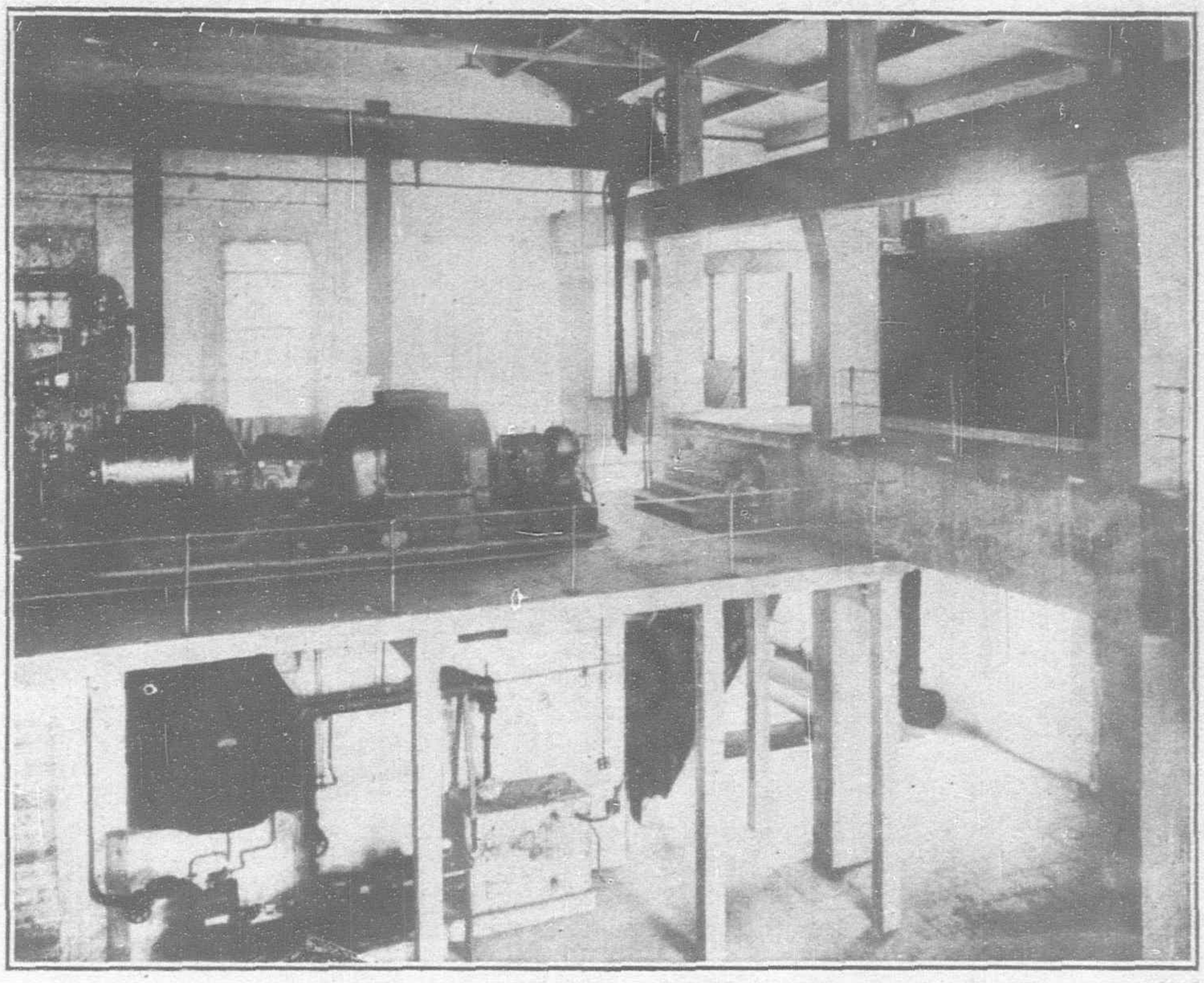
Lighting and Power Scheme

OUR illustrations show the plant installed at Pukow for the lighting and power requirements of the Tientsin-Pukow Railway at Pukow and Puchen. This plant formed part of an ambitious scheme of expansion and development which commenced three or four years ago, embracing the purchase of the well-known "Blue Express;" the purchase of several new locomotives and a large amount of rolling stock; the building and equipping of two large and modern repair shops at the railway's works at Puchen; and the inauguration of a waterworks at Pukow. All these projects have been carried out, and in two or three weeks the lighting and power plant also will be officially placed in commission.

The plant is designed to supply power for lighting the railway wharves, godowns, offices, station, and station approaches at Pukow, as well as to supply power for the workshops at Puchen and for the residences, yards and offices in the vicinity of the workshops. The plant comprises one 1,000 k.w. turbo alternator plant and one 200 k.w. steam engine alternator set, the former to carry the day load provided by the power requirements of the workshops, and the latter the lighting load which comes on at night time.

The boiler plant comprises three Babcock & Wilcox watertube boilers each of 2,852 sq. ft. heating surface, with superheaters, mechanical chain grate stokers, economiser, motor-driven Sirocco induced draught fan, and Weirs feed pumps. The boilers are designed for a working pressure of 200-lbs. per sq. in., with 200° F. of superheat. A feed water heater has been installed using the exhaust steam from the feed pumps and stoker engine.

Power is generated at 6,600 volts 3 phase 50 cycles and transmitted to Puchen at the same pressure by means of two 625 k.v.a. overhead feeders. The high-tension lines are carried underground for a quarter of a mile at each end to prevent obstruction and at the same time protect the plant from lightning.



GENERAL VIEW OF ENGINE ROOM
1000-k.w. Turbo and Condensing Plant. Switchboard on Right

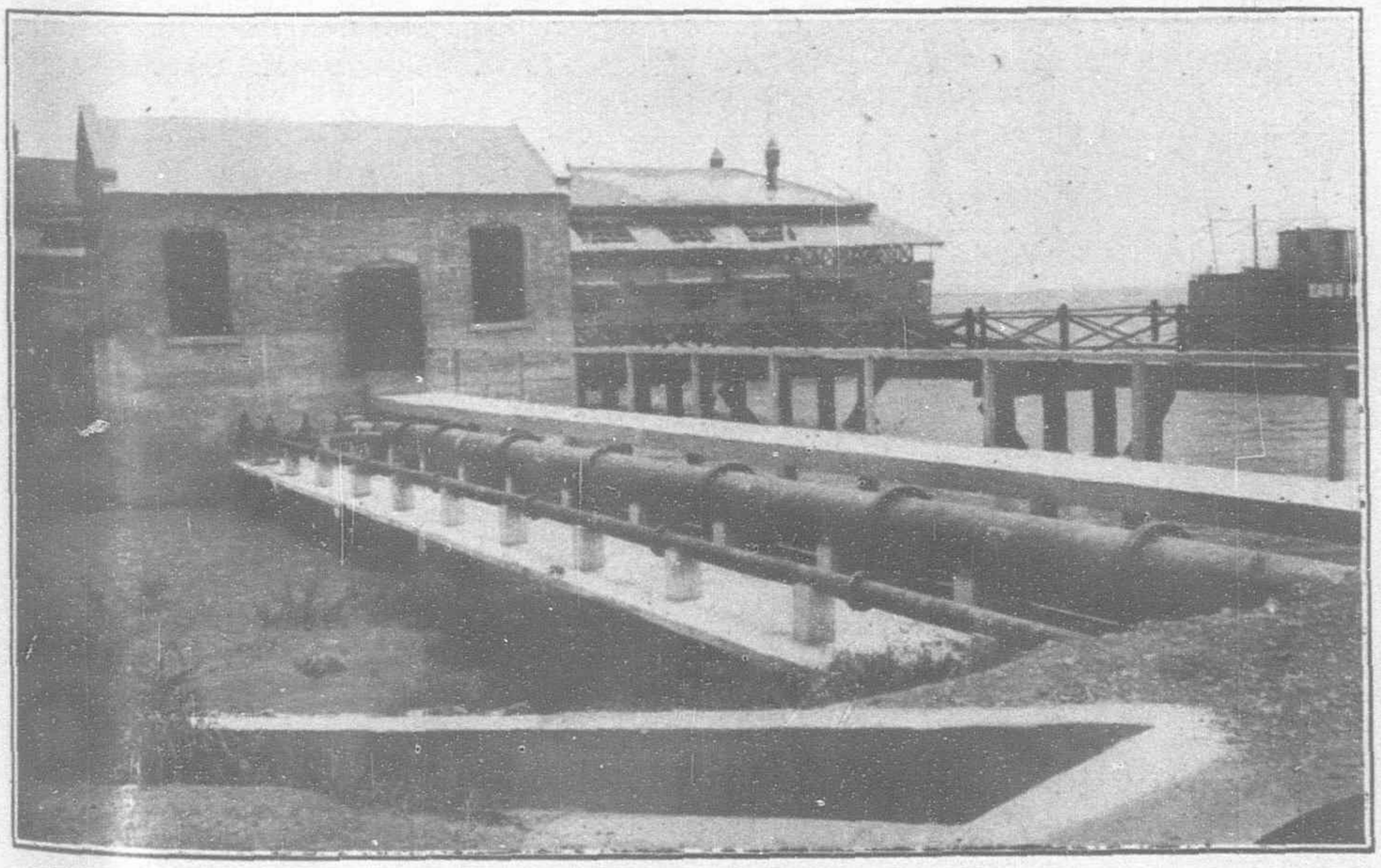
At Puchen the power is stepped down to 550 volts for distribution to the motors in the workshops, and to 380 volts for lighting, a three-phase four-wire system being adopted. There are two power transformers of the standard oil immersed type, each of 625 k.v.a. capacity 6,600/550 volts; and one lighting transformer of 50 k.v.a. capacity, 6,600/380/220 volts.

The lighting at Pukow is provided for by one 100 k.v.a. transformer, 6,600/380/220 volts, placed in the power station, from whence the low-tension 3-phase 4-wire distributors are taken. A 125 k.v.a. transformer, also located in the power house, provides power for the station accessories.

The main switchboard in the station is of the remote mechanically controlled type, the high-tension gear being enclosed in steel cubicles behind the control panel. The switchgear in the Puchen substation is of the ironclad truck type. The high-tension system is ungrounded.

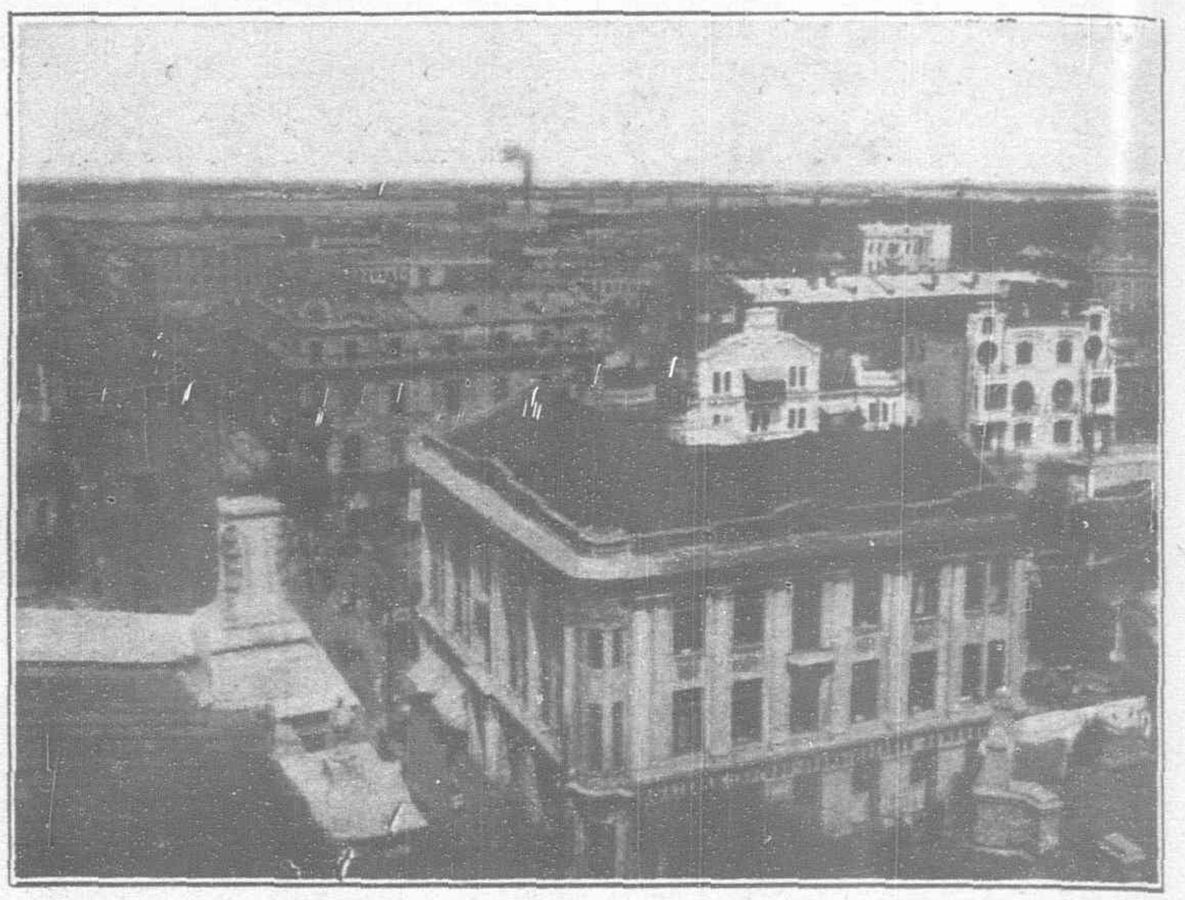
The entire contract including the supply and erection of the power plant, substation gear, transmission lines, distributors, and wiring of godowns, wharves, houses, etc., has been executed by the Jardine Engineering Corporation, Ltd. The turbo plant, steam engine-generator set, transformers, switchgear, and motors were manufactured by the English Electric Co., Ltd., and the boiler plant by Messrs. Babcock & Wilcox, Ltd.

We are indebted to the Tientsin-Pukow Railway Administration for permission to publish this article, and to the Jardine Engineering Corporation, Ltd. for the photographs and several of the technical details described.



PUMPHOUSE FOR CIRCULATING WATER
Located on River Bank—Vertical Spindle Pumps are used owing to large rise and fall of the water

View of Pristan District, Harbin



View of Kitaiskaya Street, Harbin

Harbin's Waterworks and Sewerage Project

From a Report of the Technical Committee to the City Council

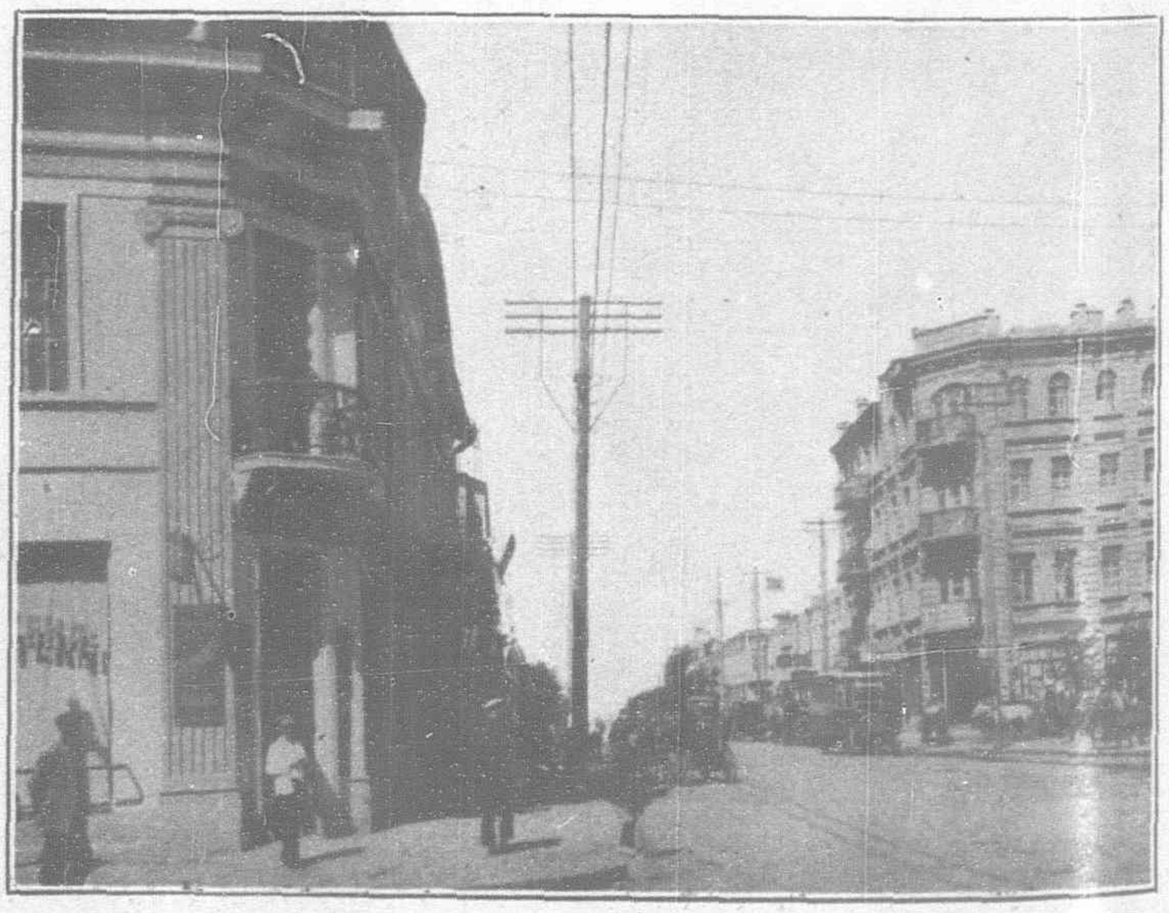
BASIC conditions under which Harbin's city council proposes to grant a concession for waterworks and sewerage systems have been elaborated by the building and technical committee after some months intensive study of the various problems involved. The water will be taken from the Sungari River, analyses of which have shown the stream to be free from nitrates and ammonia, and to carry only a trace of chlorine. Comparison of these analyses with the water of the Dnieper and the Volga show the Sungari to afford a water of high purity. It is especially free from disease carrying bacteria and has only 60 to 600 micro-organism to the cubic centimeter as against some 12,000 in the water of the Volga. Even with this satisfactory showing, it is planned to instal filterbeds which are expected to reduce the bacterial count to but one per cent. of the present low average.

The flow of the Sungari varies markedly, but at Harbin it is 113 cubic sagen a second on an average, the sagen being seven feet, this flow works out at some 39,000 cubic feet. Wells as a source of supply also were considered but the high cost of drilling and the chance that some might come in dry, has left this matter in abeyance. The population to be served by the waterworks is about 56,000 since the first installation will be limited to the Pristan and Newtown districts, but the works will be designed to accommodate almost twice as many people, thus giving a comfortable margin for growth and extra use of water.

Studies of other Russian inhabited cities have been made to determine the daily water consumption which ranges from 12.25 vodro (one vodro equals 3.25 gallons) to less than one vodro, but the average has been taken as four vodro, about 15 gallons per capita, per diem. This is considered a liberal estimate for Harbin where there are many private wells and some small pumping systems. The works capacity, therefore, has been fixed at 400,000 vodro which is expected to leave a safe margin for fire-fighting and street sprinkling.

Householders payments will be made by meter, while no charge will be made for water used in fire-fighting. House connections are at the expense of the tenants and material will be charged against them at rates to be fixed by the city. While no particular kind or make of pumping plant has been designated, the concessionaire will be compelled to put in machinery of the latest and most approved construction. The filters are to be of the American pattern and are to be designed to eliminate 99 per cent. of the bacteria in the water as it enters the beds. Reservoirs will be installed to make a safe

Mostowaya Street



Another View of Kitaiskaya Street

margin in case of sudden demand due to a breakdown in the machinery or an extraordinary fire.

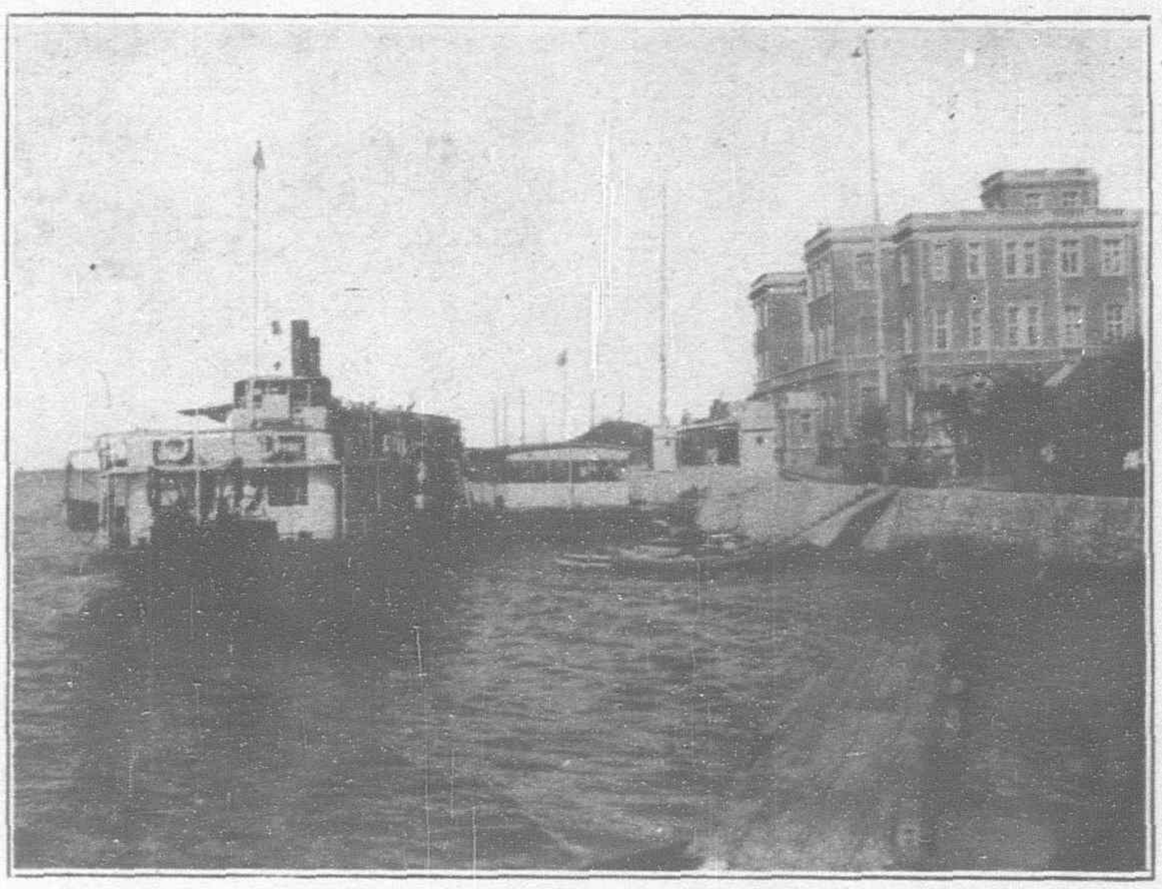
The mains are specified to stand a pressure of not less than 15 atmospheres or 220 pounds to the square inch, and the pressure on the whole system must be at least equal to a delivery head of 85 feet. Fire hydrants are to take a two-inch hose and stand a pressure of 90 pounds. Some 80 hydrants will be installed from 500 to 700 feet apart.

The question of drainage and sewerage systems was gone into thoroughly and from topographical considerations, it was decided to have two separate systems, one from the Pristan district into Machiako creek and the other, which also will serve Pristan in part, into the Sungari below the city. This dual plan takes into account, and uses the existing drainage system. Sewage to be handled is estimated at 1,200,000 gallons daily. Pipes for this system must be of iron or concrete, wood being barred.

General Provisions

The term of the concession desired must be stated in the bid and will have a bearing on the award as the city plans to take over the system itself after the expiration of the contract or even before under certain conditions. The successful bidder must put up $300,000 silver or bank guaranteed of that amount. Interest on such deposit will be paid to the depositor. If work is not completed as provided or is stopped entirely in non-fulfilment of the contract, the deposit shall be forfeited to the city which also may sue for damages.

At the demand of the city, the present contract may be cancelled: If the concessionaire has not by the end of the third year completed the work of the first category; if the concessionaire does not on time complete work according to contract of the second category; if the work of the constructed waterworks and canalization, or either of them, in whole or in part, does not function properly for more than one month, and if the bargain money is not deposited properly.



The Sungari River at Harbin

The city has the right to control the fulfillment of this contract, during the period of construction as well as during the term of duration of the concession. The city shall have the right to purchase the construction of the concessionaire prior to the period of expiration of the contract term.

During the first period, *i.e.*, within three years of building period, the concessionaire should lay not less than 25 versts of water and 25 versts of sewage pipes with all equipment relating thereto for the correct and proper functioning of the system of waterworks and sewerage. Of these nearly 15 versts of both kinds of pipe are located on the Pristan, and approximately 10 versts of pipe of both kinds are in Newtown.

Within the above 25 versts are not included feed pipes from the waterworks pumping stations, the main collector to Machiako creek, branch collectors to transfer points or other pipes not shown in the plan but necessary for the proper functioning of the systems. During the same period the concessionaire should also construct all necessary installation for removing storm overflow from the Pristan.

The construction of a waterworks and system of sewerage along streets not included in the 25 versts of the first period should be completed by the concessionaire in equal parts within 10 years from the date of completion of the construction period.

The districts where such extension work is to be performed will each time be agreed upon between the city and the concessionaire.

In conclusion the city has in mind the installation of a modern system of waterworks and sewerage by granting a concession, giving the concessionaire the exclusive right to construct and exploit such a system within city limits, as well as the right to occupy the necessary lands. At the expiration of the period of the concession, the concessionaire must turn over to the city, in perfect working order and free of charge, the entire installation, give the city the right to purchase the installation before the expiration of the concession period, and to furnish water free of charge for purposes of fighting fire.

Phones *versus* Bandits

Prefect Chao of Changchun has taken in hand the execution of his plan to construct telephone lines in his prefecture at an estimated cost of $40,000. It is to provide against possible bandit raids. He has contracted for the purchase of 4,700 telephone poles, 8,000 insulators, and other accessories. When the new telephone system gets into working order, the bandit operations are expected to be quickly ended.

Granted Shale Oil Deposits

A concession is reported to have been obtained by the South Manchuria Railway from the Chinese government for the exploitation of the shale oil fields which the firm recently discovered in Fushun. Mr. Takejiro Kawamura, president of the company, recently made a visit to Peking and held conferences with officials of the Chinese government in connection with the oil lease.

The company plans to produce 50,000 tons of oil this year at the estimated cost of Y.5,000,000, the necessary plants and equipment to be erected as soon as possible, according to Mr. Kawamura who returned to Dairen from Peking recently. He said that if results are satisfactory, the enterprise will be launched on a five-year program which will cost in the neighborhood of $50,000,000, and that it will then no longer be necessary to import oil from America.

Mr. Kawamura has left Dairen for Tokyo to make the necessary arrangements with the central government for the proposed enterprise.

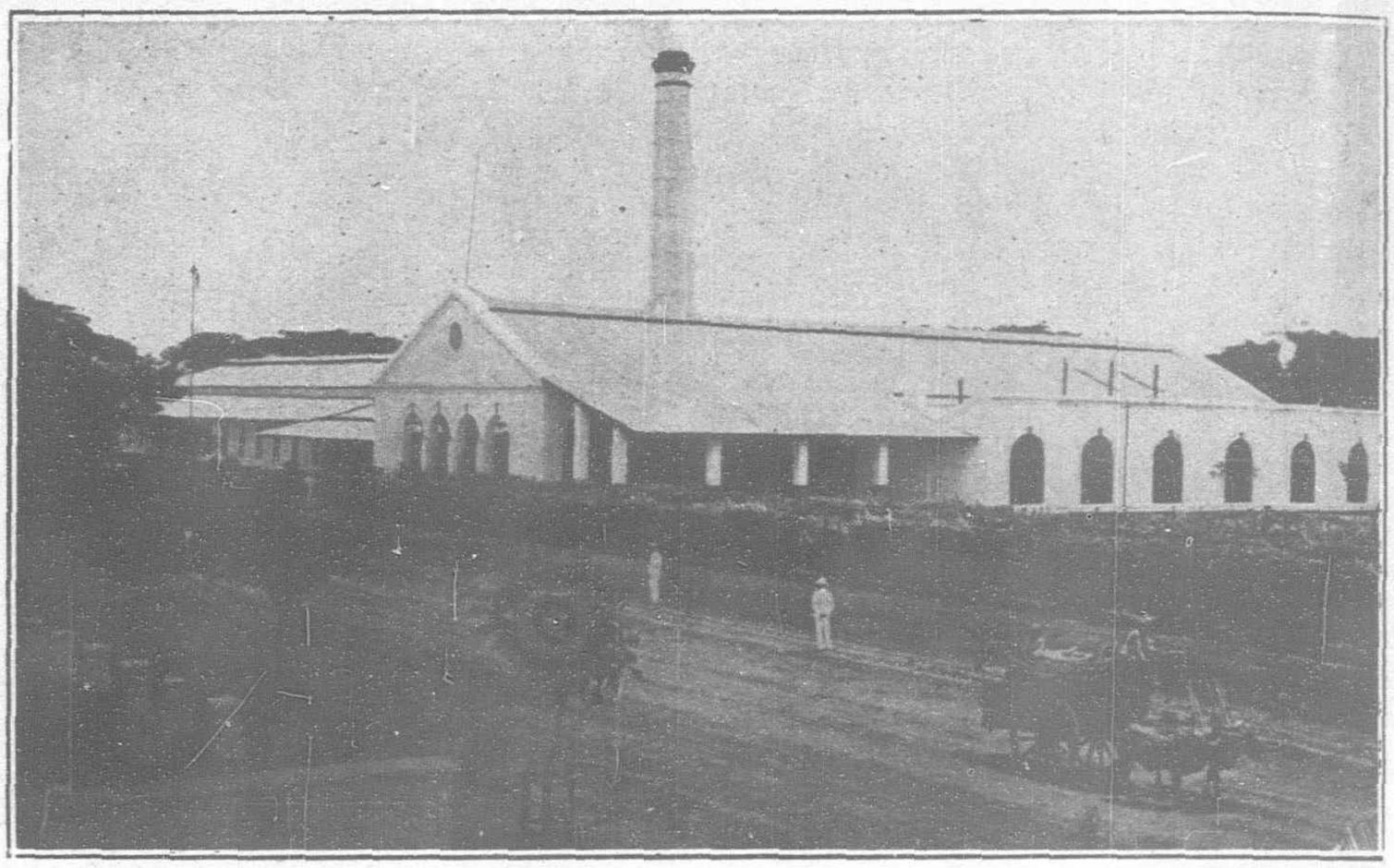
New Sugar Refinery

Announcement has been made that the Honolulu Iron Works has received a contract for the construction of a sugar refinery at Tokyo, for the Dai Nippon Sugar Manufacturing Co. The contract calls for a payment of $990,000 to the Iron Works for the job. Although the Iron Works has constructed most of the mills in Formosa, whose sugar is controlled by Japanese interests, the contract for the refinery in Japan is the first ever received by the local company from that country. A good part of the machinery for the refinery is to be built in Honolulu. Upon the arrival of J. T. Taddiken, engineer in charge of sugar refinery and beet sugar machinery, the work for the Tokyo refinery will be allocated.

Under the contracts now made the Iron Works has obtained work which will keep it fully employed for at least a year. Only a short time ago the Iron Works received $2,000,000 contract from Central Vertienties of Cuba. Two other contracts covering work in the Philippines are a $750,000 job for Central Bacolod, and a $50,000 job for Central Garcia.

Java's Sugar Struggles During Twenty-Five Years

THE jubilee number of *De Indische Mercuur*, covering a period of 25 years of successful trade journalism of the noted Holland journal published in Amsterdam, has just reached our editorial tables. The special edition is mechanically well gotten up, is handsomely illustrated and epitomizes the progress of the colonial interests of the kingdom commonly called Netherland East India to which sturdy Dutch have devoted much energy and outstanding initiative. An exceptional array of facts and figures with keen analyses of various industrial and agricultural interests, by experts who know their respective fields, are recorded in the edition. Rubber, tea, petroleum, tobacco, sugar, forests, marine matters, finance, international relationships, all are magnified and correlated to serve the large enterprises of the colonies.



Typical sugar factory in Java

Dr. H. C. Prinsen Geerligs, the distinguished authority on world sugar matters, who stands as the premier promoter and prophet of Holland sugar interests, writes the story of Java's struggles which have resulted in giving her such world leadership in the vast enterprise in which she is engaged. A free translation of the story is appended.

The development of the sugar industry in Java during the last 25 years will be easily visualized by perusing the tables of factories at work, areas planted, annual production and averages deducted.

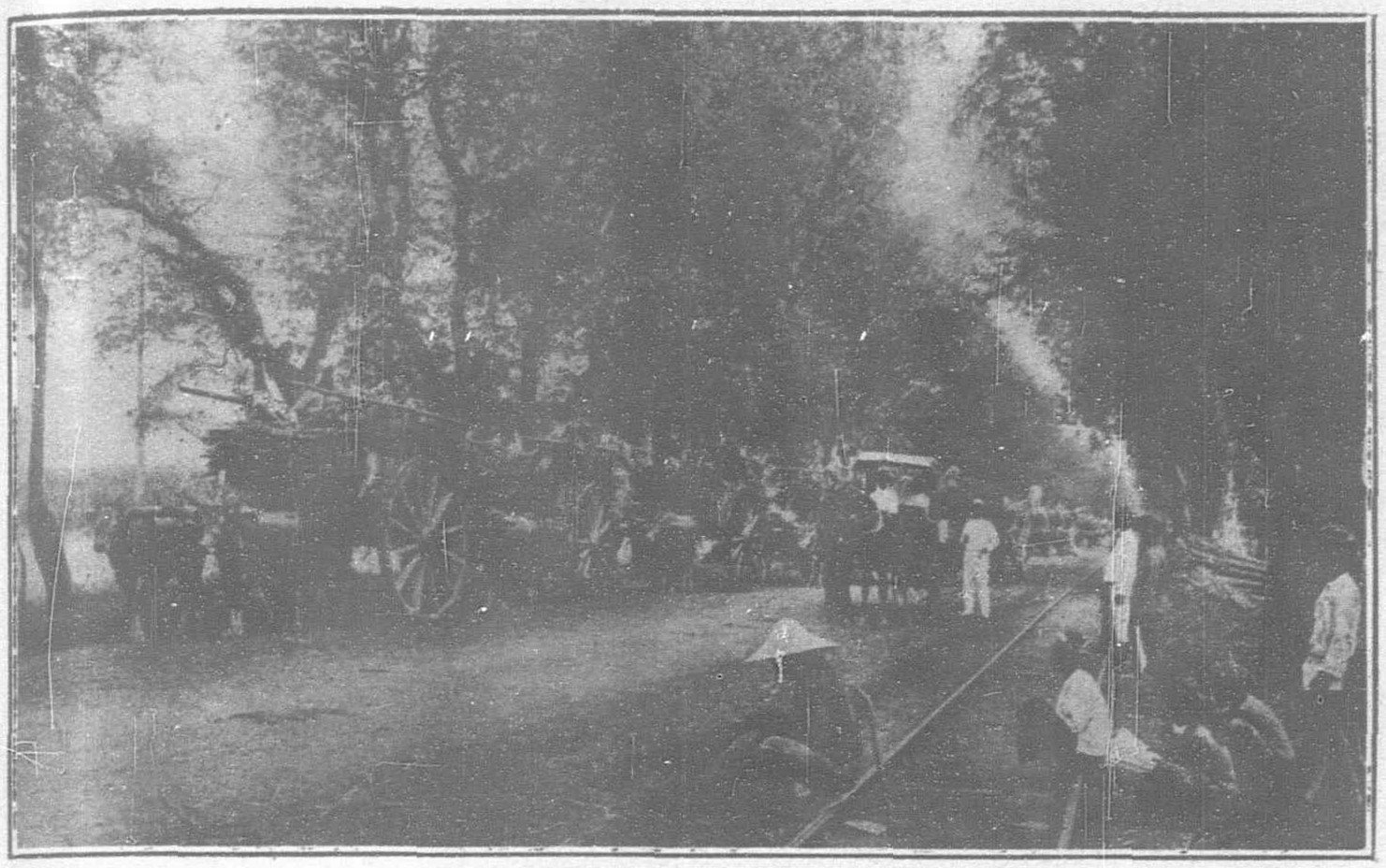
Year	Factories at work	Area in bouws	Total Sugar L tons
1898	188	113,625	725,030
1899	183	118,367	762,447
1900	182	128,301	744,257
1901	182	144,088	803,735
1902	183	147,018	897,130
1903	178	143,616	944,798
1904	176	146,078	1,055,043
1905	173	149,033	1,039,178
1906	176	156,714	1,067,798
1907	178	162,452	1,210,167
1908	178	165,686	1,241,855
1909	182	172,077	1,241,726
1910	182	178,292	1,280,300
1911	185	191,335	1,466,459
1912	184	197,707	1,406,399
1913	190	204,788	1,465,975
1914	186	207,800	1,404,942
1915	186	213,013	1,319,087
1916	186	221,823	1,629,827
1917	185	226,082	1,822,118
1918	186	229,791	1,778,207
1919	179	193,977	1,336,112
1920	183	219,925	1,543,923
1921	183	224,724	1,685,334
1922	182	226,760	1,808,036

From the table it is apparent that the number of sugar factories remained practically the same in 25 years, around 180. But the cane area increased, especially between the years 1900 and 1913, since then, however, it has remained about the same.

Preparing the land for sugar-cane planting

At the beginning of the period under consideration the sugar situation in the world was not very hilarious and in Java not at all favorable. This time marks the era of the tariff wars which began in 1884 and which resulted in the doubling of the export premiums in Germany in 1895, taking on a malignant form to strangle real industrial incentives.

Thus premiums offered for exports obtained by levying surtaxes gave the beet sugar manufacturers strong protection and they could freely flood the markets of Great Britain, the United States and British India thereby offering sugars very cheap and depressing the prices on the world sugar market. Java sugar had no such unnatural bolstering by the government's offering a premium and therefore was not in a position to make any conquests in the free markets. Yet this was the time when modern scientific research was beginning to blossom forth in fields and factories. Splendid advances were made in the



Cane transport near the factory

study of soils and plant diseases and insects and carried with fertilizers and special researches were made in them a large increase in the area planted to cane. In the factories also the work was pursued assiduously where technical and mechanical improvements were made and the owners of factories had no fears of investing in large sums to improve not only the machinery but their transportation facilities making real endeavors to raise the sugar tonnage and therefore lowering the cost of manufacture.

What was exceedingly disheartening was that all this extra effort was battered down by the European beet sugar manufacturers by the regulations they made continually lowering the market prices so that the manufacturers in Java never could see ahead to know whether they had a chance to exist.

This menace brought about long negotiations which precipitated a great move on the part of Great Britain against the rigidity of a system of premium fed sugars enforced by kartels. Out of this agitation the Brussels convention arose, with which the Netherlands government began to co-operate at once. Beginning with September 1, 1903 the conclave began to operate, various great powers having banded themselves together to place sugar on a basis minus premiums or artificial aid so that foreign and home sugars were not shunted below certain levels in price. Sugar was given the free channel of economic possibility according to supply and demand.

Through this plan free competition was assured for sugars coming from any quarter and this was the beginning of the upswing of the Java sugar industry, and a proper reward for all the strenuous labors and sacrifices in the past years, the free competition being such that Java could profit thereby. While many other countries had just begun a renewal and an enlargement of the industry, Java was prepared and ready to enter and appear on all markets. This is apparent when it is noted that in 1903 the sugar production was 950,000 tons while in 1913 it had risen to 1,465,000 tons.

During all these years many things have happened. In the first place the large measure of success was due to the bringing in of new cane varieties, which were decided upon after various experiments with the seed, bringing about the expansion of the planted area and a greater certitude of results in which the Cheribon cane variety majored as being freer from disease than most other canes. In the second place, in the period from 1893 to 1903 Java produced great quantities of raws which found their way to the United States but with the rejuvenation of Porto Rico and Cuba the doors were closed, the last two named countries being the neighborhood to furnish the refineries with plenty of raw material. Other markets had to be found and British India was opened where immediately after the Brussels convention the white crystal sugars from Germany and Austria were crowded out through the white sugars from Java. At the beginning, the different varieties of sugar were only made on a small scale but in the last few years with the increased production one half of the outgoing Java sugars were white crystals going to British India, Great Britain, France and the countries around the Mediterranean Sea.

The years following 1900 show that there has been an increase in quantity and quality and though the prices were not always what was desired yet prior to the war of 1914 the industry enjoyed a period of well being and prosperity. It is not to be wondered at therefore that the prosperity of the industry awakened suspicions and that repeatedly charges were made against it, that the industry tried to take advantage of certain agrarian conditions, such as renting of lands, obtaining irrigation waters, lowering of wages, etc., thereby seeking to justify its own existence.

At a hearing of the commission of inquiry looking into the diminishing prosperity of the domestic populace between the years 1894 nd 1908 it was repeatedly apparent that a feeling existed which could not be rectified because the sugar manufacturers, being in the minority, could not or would not be heard, being unable as citizens to give their own views.

In order that such a minority might better its position, the manufacturers closed a combine in 1894 and called it the " Algemeen Syndicat van Suikerfabrikanten of Java " open to all engaged in the industry. In 1907 the syndicate had the satisfaction of acting as official commission to the government in matters of the sugar industry in Netherland-India, acting as advisor, thus becoming a voice for its own interests. In the year 1906 it took over the sugar magazine *Archiev voor de Java Suiker Industrie* which had existed since 1893 and since the year 1912 it has also directed the experiment station for the Java sugar industry besides administering different funds related to the industry, thus expressing the fellowship of the producers of Java, putting the sale of sugar into one selling agency.

August of 1914 the great European war broke out and the crop was about half sold and did not bring the highest prices. The British royal commission for provisioning sugar during the years 1914, 1915 and 1916 procured large quantities of sugar on the Java market which prevented the industry from having any causes of worry. Then in 1917 a change came when the commission began to receive consignments of sugar from other countries. A large boat tonnage had been destroyed by submarines and the allies

Harvesting sugar-cane in Java

were crowded for provisions and had to practice economy with their boats. The powers agreed not to send ships to Java to bring sugar to Europe and decided to bring all necessary needs from Cuba and the United States. British India and Australia were not in need of large quantities because they were reducing their sugar rations also.

The result of this was that the warehouses in Java were full of sugar and the individual men were inclined to stand off the prices then current for sugar. The one class that seemed to have an advantage were the profiteers who hoped to play one owner against the other to lower prices, but the holders addressed themselves to the Java sugar combine and were protected. This combination was better able to stabilize prices and to steer the crop of 1918 better than individual holders could. Thus prices were stabilized; those who wanted to take advantage of the situation were not large enough in numbers to drive out the combination and even though the new crop of 1918 was approaching and the visible supplies of the splendid crop of 1917 were still in part on hand, the prices remained stable, in keeping with the situation.

The hardest blow came when in March of 1918 the allied powers requisitioned the Netherland ship tonnage and therefore hindered the exportation of sugar to neighboring lands. Through the selling combine in the Netherlands, the quantities of sugar were moved in three months, 90 per cent. of the sugar producers of the "Vereennidge Java Suiker Producenten" assisting. The latter society held the remainder of the 1917 crop and the whole output of 1918 and therefore had a hand in the disposal, which action made prices firm even though certain doors were closed.

The cessation of the intercourse of Java with her neighboring lands heightened the discontent because rice could not be brought from British India and Siam and thus the food supply was reduced. Though the scarcity was not as great as in the motherland yet it gave rise to all sorts of excitement and revolutionary spirit, causing grave concern. One consequence of this spirit was an order to reduce the amount of irrigation waters for crops by 20 to 25 per cent. but fortunately this was not carried out. A number of owners of sugar factories were practically ready to enter upon this restricted irrigation, in fact the figures show that the area in 1919 was 36,000 *bouws* (.709 hectare) or 16 per cent. less than the year before, but this was the result of anticipation and was voluntary, and naturally the output was thereby reduced.

At the time of the armistice in November, 1918, immediately a new condition was at hand; with one stroke the borders hemming in the Java industry fell away and with a magic hand the crop of 1919 was distributed, arriving in the countries for which the sugar was destined. The former area was nearly reached again in 1920, but strikes and cane fires, largely the work of men of the revolutionary spirit, retarded matters some.

The great success of the Java sugar industry since being freed from governmental regulation is not due to government aid or support as is the case in some sugar exporting lands, but is the result of the solidarity of all interested who do not look upon each other as competitors but who work together with energy, open heartedness and integrity, trusting one another, sharing each others burdens and difficulties and unanimously putting their hearts into the work of an industry dear to all.—S. G. RUEGG, in "*The Louisiana Planter.*"

Japan's Railway Extensions

The railway line along the coast of the Japan Sea will be perfected with the completion of a line between Nezumigaoka and Murakami stations on the Uyetsu line under the control of the Sendai district bureau when thorough traffic will be opened from Aomori in the north to Shimonoseki as its southern terminal. The work of connecting the two stations is now going ahead and the authorities expect to complete it during the present year. According to the railway authorities, the government is extending the imperial railway lines by roughly 300 miles a year and the average increase in the number of stations is about 80 a year. For these extensions about Y.50,000,000 is spent each year.

Mount Mayon and the Town of Legaspi, Albay Province, Luzon

Manila Railway Report

Operating Revenues Drop Nearly a Million Pesos

THE Manila railroad company made a net profit of P.1,285,275.93 in 1923, according to the annual report of General Manager Jose Paez to the stockholders and board of directors recently made public. This net gain, however, is lower than that of 1922 by P.996,042.-77 or 43.66 per cent., the report shows.

The management has been able to reduce the operating expenses, which in 1922 amounted to P.7,300,646.83, to only P.6,867,-257.43 last year or a saving of P.433,389.40, according to the report. This saving is nevertheless offset by the fact that the operating revenues in 1923, amounting to P.11,505,525.51, were lower by P.705,272.26 than those of 1922 which amounted to P.12,210,797.77.

Dividends Inadvisable

Until all needed improvements indispensable to the economical and efficient operation of the railroad are undertaken the general manager considers it inadvisable to consider diverting any portion of the earnings for the purpose of paying dividends.

During 1923, the report points out, there was in use 1,047.132 kilometres of single track rail, and 13.386 kilometres of double track or a total of 1,060.718 kilometres. There were also operated 155 locomotives and 2,144 cars and coaches of various kinds. The company undertakes the location of 70 additional kilometres of road in its southern lines, thus leaving a distance of 37 kilometres yet to be located of the proposed line which will link the Legaspi division in the Bicol region with the main southern line ending at Aloneros, Tayabas province.

Explaining the decreases in revenues and expenses the annual report states :

Revenues Decrease

"The decrease in total operating revenues of 15.8 per cent. indicates a slight decrease in the volume of traffic handled during the year 1923 as compared with 1922. It will be noted that operating expenses were only reduced by P.433,389.40 while operating revenues were reduced by P.705,272.26. As is usually the case, the cost of doing a smaller volume of railroad transportation business did not decrease as much as the decrease in the total operating revenues. In other words, in relatively poor years revenues decrease faster than expenses and in good years revenues increase faster than expenses. However, it should be noted further that the ratio of decrease in expenses (5.9 per cent.) was slightly greater than the percentage of reduction in revenues (5.8 per cent.) The operating ratio (proportion of operating expenses to gross operating revenues) was 59.69 per cent. for 1923 as against 59.79 per cent. for 1922. This is rather surprising in view of the reduced revenues, but is a result of the fact above stated that expenses decreased in a slightly greater proportion than the percentage decrease in revenue, *i.e.*, $\frac{1}{10}$ of 1 per cent. although the reduction in revenues (P.705,272.26) was P.271,882.86 more than the reduction in expenses (P. .433,389.40).

Non-operating Income

"The large reduction in non-operating income of P.74,264.67 (31.78 per cent.) deserve special mention. This is due to the fact that in 1922 the sum of P.142,480.22, representing premium on sale of sinking fund bonds less expenses incident to their flotation, was credited to non-operating income, and this was only partially offset by increases in 1923 in various items of non-operating income.

"The total net profits of P.1,285,275.93, while smaller by over 43 per cent. than in 1922, indicate that the Manila Railroad Company is gradually working into a sounder position financially and was able to save a fair proportion for net out of its gross revenues considering the several adverse factors with which it had to contend during the past year.

"As has occurred for several years previously, passenger revenues show the greatest reduction as compared with other items of income. However, the decrease of P.402,099.59 is P.123,244.61 less than the decrease in 1922 from 1921. The number of passengers carried in 1923 was 6,015,382 as compared with 6,501,363 in 1922, a decrease of 485,981 or 7.4. per cent . . . It is hoped that possibly the limit in decline has been reached and that in the future passenger revenues at least will hold their own if not show improvement. The total revenue freight tonnage for 1923 shows a decrease of 57,314 tons from 1922 or 4.9 per cent.

Water Lines Prosperous

"Considering the decreases in passenger, freight and express revenues, it is encouraging to note that the operation of the water lines show increased receipts of P.31,479.68 or 17 per cent. making operating income for 1923 P.206,068.54. This resulted in a net gain of P.32,799.07 as compared with a loss in 1922 of P.5,856.93 which in turn was preceded by a loss on operation of approximately P.88,000 in 1921."

At the beginning of the year 1923, the report states, the financial position of the Manila Railroad Company presented a marked contrast to that at the beginning of 1922, when there were unsettled pressing obligations amounting to between P.3,000,000 and P.4,000,000 with almost no funds available to discharge them.

The situation in 1922 is ameliorated and the crisis averted by the placing of P.3,000,000 bond issue in the United States and consequently at the beginning of 1923 as a result of the step taken and the current receipts from operation, there was a cash balance on hand of P.1,420,370.96, and all obligations in the shape of bond interest notes, bills for coal and other supplies had been met when they became due.

Improvements Needed

"While it is true that the operating expenses of the company have decreased from the peak reached in former years," the report explains, "it is believed that the rates charged should be sufficient to secure an income adequate to produce a reasonable profit on capital invested. This fund can then be devoted to urgent improvements and betterments that are essential for the economical and efficient operation of the railroad without repeatedly seeking outside financial assistance in the way of bond issues or other indebtedness which continuously increase the fixed charges of the company.

"It is firmly believed," the report also avers, "that the rate structure should be maintained at such a point as to insure the ability of the company to earn a reasonable amount over and above operating expenses."

Regarding traffic conditions in 1923 the general manager says in his report that they have not materially changed from those of 1922 except that competition has been felt more acutely and there have been greater losses from auto-truck operations affecting passenger, freight and express earnings. The long haul business, it is pointed out, has increased while the short haul traffic has decreased. Difficulties met through keen competition of truck services were in part overcome through reduced rates by means of round-trip tickets.

Recommendations Made

Recommendations made in the report follows:

1. Increase in capital stock through floating by the insular government of P.14,000,000 worth of bonds. This would be used in the purchase by the government of 70,000 shares of the company which fund is in turn to be used by the company for needed construction and extension work such as the Aloneros-Pamplona line in the Bicol region, the Bauang Sur-San Fernando, La Union and the San Quintin-Tayug, Pasgasiman.

2. Short term financing: Arrangement of loan of P.2,000,000 from postal savings bank and teacher's pension fund on proper legislative authority to be paid in annual installments of P.500,000 with interest at the rate of 6½ per cent. in four years time. This is to be used in needed improvement of present lines and betterment of present facilities and services, which would ultimately reduce cost of operation. Among projects for which these loans are intended are raising of road-bed above flood level, prohibitive grades and additions to rolling stock.

3. Sinking Fund: Setting aside reasonable amount each year for the creation of sinking fund for redemption of bonds.

4. Appropriations from surplus earnings: Income in excess of ordinary requirements be utilized in the financing of general improvements and betterments. The late Manager McCoy estimated that P.11,000,000 could be expended with great benefit to property in improving existing facilities.

Operating Revenues and Expenses

Total operating revenues for 1923 were	P.11,505,525.51
As against that of 1922	12,210,797.77
A reduction of 5.8 per cent.	705,272.26
Total operating expenses for 1923 were	6,867,257.43
As against that of 1922	7,300,646.83
A reduction of 5.9 per cent.	433,389.40
Total operating income for 1923 was	4,577,631.23
As against that of 1922	4,887,748.32
A reduction of 6.34 per cent.	310,117.09
Total non-operating income from 1923 was ..	159,430.44
As against that of 1922	233,695.11
A reduction of 31.78 per cent.	74,264.67
Total fixed charges and other deductions	2,739,056.67
As against that of 1922	2,778,917.16
A reduction of 1.43 per cent.	39,860.49
Total net income for 1923 was	1,998,005.00
As against that of 1922	2,342,526.27
A reduction of 14.7 per cent.	344,521.27
Total income applied to Sinking Funds	570,233.00
As against that of 1922	4,488.00
An increase of 12.600 per cent.	565,745.00
Leaving a net balance transferable to Profit and Loss Account in 1923 of	1,427,772.00
Ae against that of 1922	2,338,038.27
A decrease of 38.9 per cent.	910,266.27
Total net profits after deducting profit and loss adjustments for 1923 were	1,285,275.93
As against those of 1922	2,281,318.70
A decrease of 43.66 per cent.	996,042.77

The Philippine Railway Co.

The 18th Annual Report by V. Pres. R. R. Hancock

FOLLOWING is the report of the operations of the Philippine Railway Company's lines in the islands of Cebu and Panay, Philippine Islands, for the year ended December 31, 1923:—

Total operating revenues for the year amounted to $618,672.13, as compared with $643,232.02 for the year 1922, a decrease of $24,559.89. Operating expenses amounted to $488,989.95 as compared with $473,464.76 for last year, an increase of $15,525.19. Net earnings were $129,682.18 as compared with $169,767.26, a decrease of $40,085.08. Freight earnings were practically the same as for the year 1922. Passenger earnings fell off $24,377.51; other transportation revenues decreased by about $3,000, and incidental revenues increased by a like amount. The ratio of expenses to revenues was 79.03 per cent., and for the previous year 73.61 per cent.

Passenger business has been steadily falling off for the past several years. This is due to a decline in the number of people attending the town festivals, and to the very large number of automobile trucks and small cars operating in competition to the railway over the excellent roads which parallel our Cebu line for its entire length, and for some thirty kilometres at each end of the Panay line. These cars also handle more or less freight. The automobile rates are fixed by law, but as there is practically no enforcement of the regulations, they charge a few centavos less than the railway whenever this is necessary to secure the business.

In order to meet this competition, we have established a more frequent train service on both divisions. One daily train over the entire division was added to the Cebu schedule. The service from Iloilo to Pototan, a distance of thirty-three kilometres, was increased by three daily trains, and on the north end a Ford track auto truck and trailers with capacity for seventy-five passengers makes two trips daily to Buntog, an important town thirty-seven kilometres out from Capiz. On the Cebu division the competition is very keen, and it was deemed advisable to reduce the passenger fares to the rates in effect before the increases made on account of war conditions. The rates had been increased thirty per cent. The reduction was made in September, and we are now carrying a much larger number of passengers, and the revenues have materially increased. It does not seem desirable to make any reduction in rates on the Panay division.

Less Coal Mined

The coal mines on Cebu are not producing as much as in previous years. The output of the National Coal Company was about normal. The Danao mines are getting out a very small amount. All the Uling Company produces is taken by the Cement Company without passing over our line.

The sugar central located on the Panay division is having a successful season, and will produce about 3,800 tons of sugar. There is every prospect that this amount will be doubled next year. The mill will be altered to take off six hundred tons of cane daily, instead of four hundred as at present. We are applying for government authority to purchase fifteen cane cars to handle the crop.

Our cane tariffs must necessarily be low per ton kilometre, as the average haul is twenty miles. The railway freight rate is about sixty cents for each ton of cane delivered at the mill. We charge $3.60 freight per ton of sugar, and obtain a fair revenue from the incidental business. Sugar development is only starting on Panay. There are large areas of excellent sugar land still untouched, and with the success of the Negros centrals and the one on Panay, there is reason to believe that other mills will be erected along our line.

The cement plant on Cebu commenced operation the latter part of the year, and is producing about one thousand barrels a day, which is shipped over the railway to Cebu. This is a well-equipped, modern plant and produces cement of excellent quality which finds a steady market. Two recently completed irrigation systems supplying water to fifteen thousand acres of rice land are in successful operation near Iloilo, part of the territory being tributary to the railway.

Operating Expenses

Total operating expenses for the year were $15,525.19 greater than for 1922. The wages of our employees and the costs of ties, coal and all other materials are about double the prices of ten years ago. There is little prospect of a reduction in these items due largely to the increased demand caused by sugar centrals on the adjoining island of Negros for mechanics, track men and materials produced locally. Tracks, buildings and equipment now require more repairs than during the first few years after construction was completed.

Total expenditures for track labor and material amounted to $139,308.32, an increase of $2,157.34 as compared with last year. Tracks, bridges and buildings were well maintained, and replacements were made where necessary. The condition of the wooden tretles on Panay was much improved.

Expenditures for maintenance of equipment amounted to $90,310.32, a reduction over the costs of the previous year of $2,438.52. Nine locomotives were overhauled and twenty cars were rebuilt or extensively repaired. Next year four locomotives will receive heavy repairs and thirty cars will require rebuilding. One of the Panay power house boilers was partly renewed, and all equipment was kept in a good state of repair. Three steam tugs and six small barges are operated. Two tugs and three barges are for transferring the company's own freight and for miscellaneous work in Iloilo harbor.

Transportation expenses increased by $15,579.70 over those of the previous year. There was a considerable increase in coal consumption and wages of train crews due to the increased train service. Total locomotive kilometreage amounted to 583,924. Fire damage claims on Cebu amounted to $6,961.28 for several houses alleged to have been burned by sparks from the switching engine.

Total locomotive fuel consumption for the year amounted to 9,136 tons of coal and 398 cords of wood. All the coal used by locomotives on Cebu, amounting to 4,044 tons, was purchased from the local mines at a cost of $8.34 per ton on pile. On Panay we used 3,429 tons of Australian coal, costing $11.50 per ton on pile, and 1,663 tons of Chinese coal at $9.25 per ton on pile. On account of the silting up of the Iloilo river, all coal purchased for the Panay division must be lightered from the straits at a cost of $1.60 per ton from steamer to pile.

The following tabulation shows the costs and consumption of fuel used on locomotives for the past two years:—

	1923	1922
Total value on tank	$98,193.09	$88,598.22
Cost per ton on tank	9.98	11.89
Total consumption, kgms.	9,334,579	7,449,461
Total locomotive kilometreage ..	583,924	444,966
Consumption per locomotive kilometre, kgms.	15.99	16.74
Consumption per 100 ton kilometres, kgms.	10.21	9.90

Expenditures for additions and betterments amounted to $4,319.81. These additions consist of a new water station in course of construction on Cebu; a steel dock derrick partly completed on Panay; and two track auto trucks and trailers for service out of Capiz. One lighter carried on our books at $3,500 was lost at sea, and another carried at $1,500 was scrapped. These lighters were purchased several years ago for use in wood service and more than paid for themselves in reducing the cost of fuel during the high price of coal. One trespasser was killed by a locomotive, and a passenger was severely injured by jumping from a train. Two road automobiles were struck by locomotives and six persons slightly injured. The Railway Company was held blameless in each instance.

The interest in the outstanding 4 per cent. first mortgage bonds of the Company amounted for the year to $341,960.00; of this amount, the Company was able to provide from earnings, after appropriating $4,319.81 for additions and betterments, $125,714.88, or 37 per cent., and the Philippine government, in accordance with the contract of guaranty, advanced the balance, or $216,245.12. The total of advances made by the government to December 31, 1923, to meet interest on bonds is $3,509,653.63, repayment of which is not obligatory until after maturity and repayment of bonds.

The following are the equivalent values of the units in this report:

One Ton	= 1,000 kilograms = 2,205 pounds.
,, ,,	= 1,000 litres = 264 gallons.
,, ,,	= (freight meas.) 2 C.M. = 70 cu. ft.
One Kilometre	= 0.62 miles.
One Mile	= 1.61 kilometres.
One Metre	= 39.37 inches.
Two Cords of Firewood	= 1,000 kilograms coal.

Machinery Demands

The demand for woodworking machinery and equipment has increased considerably in Canton during the past two years, according to Vice-Consul Howard Bucknel, Jr., Canton, China, and is credited to the increasing cost of labor which is forcing producers to use labor-saving devices. The largest consumers of this class of machinery are the government in its arsenals, airdromes and railway shops, which use band saws, planers, tenoners, and other special woodworking machinery. The local match works imported a number of circular, swinging, cut-off and band saws, while the local cement plan has in use a number of machines for barrel making.

Labor shortage in India has greatly stimulated the use of coal-cutting machinery in the Indian coal mines, according to report to the department of commerce from Trade Commissioner C. B. Spofford, Jr., Calcutta. Most of the large collieries in the various fields are now equipped with electric power. Forty electrically driven coal-cutting machines were in operation in the Ranesgunge and Jherria fields and during 1922 these machines cut a total area of 1,065,456 sq. ft. In addition, three machines operating on compressed air cut 190,890 sq. ft. in the Jherria field. One colliery has introduced a mechanical loading conveyor which operates by compressed air. A movement is now on foot to increase the coal carrying capacity of the railways and also increase the output of the mines.

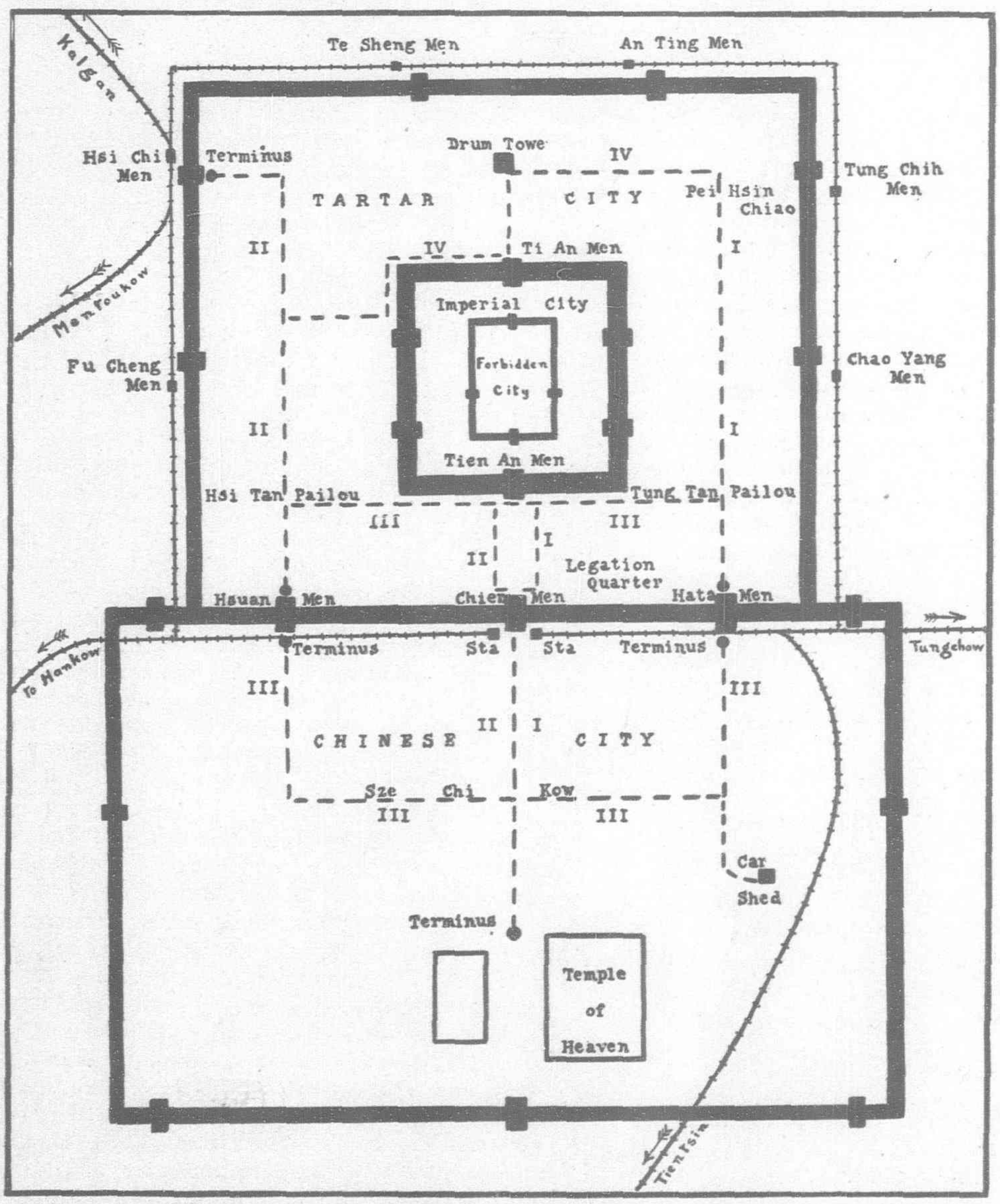
The Peking Tramway System

Modern Developments in the Ancient Capital of China

By Laurence Impey

IT is over ten years now since the first agreement relating to the construction of tramways in Peking was signed by the Chinese ministry of finance and certain French interests represented by the Banque Industrielle de Chine, and it is an excellent example of the Oriental policy of *laissez faire* that even now the completion of the undertaking is not really in sight. It is true that some of the construction work has been done, and that at the present time some fifty kilometres of track has been laid, but the rest of the installation is proceeding in so leisurely a manner that it will probably be necessary to commence repair work on the first stages before the last ones are in place. The initial delays to the work were undoubtedly political in their origin, and if a full account of these is ever made public it will afford an interesting insight into the peculiarities of commercial enterprise and development as practised in China.

The scheme as originally outlined in the port of Pukow agreement was feasible enough of course, and it was presumably only the outbreak of the war that prevented its being put into execution immediately, but this unexpected development, by the pressure which it exercised on French finance, naturally altered the whole trend of affairs and caused the agreement to be held in abeyance until the spring of 1921, at which time a new contract was drawn up and signed by the ministry of finance and the Banque Industrielle de Chine.



Map of Peking Tramway System

The fact that such a profitable undertaking had been secured by French interests had of course considerably disappointed various other financial and engineering groups, and the hindrances in organization presented by war conditions afforded an excellent opportunity to these disgruntled competitors of which they were not slow to avail themselves. The opposition was considerably strengthened by the financial difficulties of the Banque Industrielle during the latter years of the war, and it was apparent that the climax had been reached when in May 1921 the Banque was forced into involuntary suspension.

The first move to follow was the appointment of a German engineer to take charge of the work on behalf of the company, and this event produced reactions which have proved to be of the utmost importance since. Specifications were immediately drawn up for the materials required and these were so worded by the engineer as to comply with standard German construction work, thus enabling German firms to submit tenders in the short space of time allowed and greatly hampering other foreign firms who were desirous of submitting plans and bids. In spite of the fact that French interests eventually regained the supremacy this action was of vital importance in the long run, as is evidenced by the number of tenders which were secured by Germans in the face of considerable opposition. The following short list gives some idea of the predominance of Germany along certain lines in engineering construction in China, and may serve to disprove those assertions which have lately appeared in the press to the effect that German commercial and financial interests in the Far East are almost negligable in importance.

Contract No. C.—Convertor Station Transformers. Siemens-Schuckert & Co. (German)

Contract No H.—Winding Shop. Siemens-Schuckert & Co.

Contract No I.—Joinery, Shop. Chinese Commercial Corporation. (Kirchner) German.

Contract No L.—Repair Shop. Siemens-Schuckert & Co.

Contract No N.—Overhead Line Equipment. Siemens-Schuckert & Co.

Contract No F.F.—Transmission Signals Equipment. Siemens-Schuckert & Co.

Contract No K.K.—Precision Testing Instruments. Siemens-Schuckert & Co.

Examination of the complete list of tenders shows that the German group have secured seven to the French four, the British having obtained six and the Chinese the same number; and it is reasonable to suppose that the French interests that now control the work would not have approved this if it had been possible for them to arrange for some emendation or to call for fresh tenders.

The financing of the scheme has involved considerable difficulty owing to the suspension of the Banque Industrielle, for the original arrangement was that the shareholders should provide one half of the funds required, while the ministry of finance, representing the Chinese government, should not be liable for any direct payment but should be carried by the Banque acting as its financial representa-

tive. The first and second calls issued by the company amounted to two million dollars, the third one called for another five hundred thousand, and up to April 1924 a total of four million dollars Mex has been called up and expended, while the directors are now considering the adviseability of asking for another million dollars in the immediate future.

It is somewhat surprising, when one considers the unsettled conditions in China, that the private shareholders have been willing to provide such an amount, secured as they are only by the materials of the tramway itself and certain of the municipal taxes of Peking, which might very well not be forthcoming in case of necessity. These financial details are, however, of somewhat secondary importance, for the tramways are now in the nature of a "fait accompli" and it is far more interesting to consider the actual engineering and construction details of the work now under progress.

The general plan of the system is to install a power plant at Tungchow, some sixteen miles from Peking, and by obtaining water from the upper reaches of the Pei Ho and passing it through a large settling tank enable them to operate three Babcock & Wilcox water-tube boilers for the turbo-generators. These boilers have a heating surface of 4,400 square feet and a working pressure of fourteen atmospheres (210-lb. pressure). They are fitted with economisers and chain grate stokers. The three turbo-generators which were supplied by the Swiss firm of Brown Boveri & Co. will provide 3,000 kilowatts, one being of 1,500 kilowatts and the other two of 750 kilowatts apiece ; while space has been reserved in the building during construction for the installation of another group of 3,000 kilowatts which it is expected are to be ordered shortly. The generated voltage of 5,000 volts is stepped up to 33,000 volts for transmission from Tungchow to Peking by extra high-tension cable, and is stepped down again at the Peking transformer station close to the Hatamen gate. The total cost of the installation at Tungchow is in the neighborhood of $200,000, while the buildings for the housing of the engineering staff, together with the settling tank which is not yet erected, will cost another $200,000.

The current from the transformer station at Hatamen is passed to the two convertor stations at Nan Ho Yen and San Li Ho in the south and north Tartar city respectively. Here it is converted from alternating to direct current, the south station having two Hexaface rotary convertors with a capacity of 375 kilowatts at the D.C. side and a voltage of 615, while the north station has two Hexaface rotary convertors of compound winding with commutating poles and a capacity of 225 kilowatts at the D.C. side and a voltage of 615 as in the other installation. These two stations are not yet completed, but it is expected that they will be working by August next if not earlier. The capacity of the whole of the electrical plant both at Tungchow and in Peking is well above the requirements of the tramway system as at present projected, but it is expected that there will be an ever increasing demand for its services once it is operating, while it is also suggested that it might be possible to use the surplus current for an electric light supply in the future, the present one being somewhat inefficient, both in capacity and operation.

The laying of the track has been completed already, the rails used being of the grooved type with a weight of forty-seven kilogrammes per metre, though a lighter type of trail has been employed for the track to the car sheds and repair shop. The joint for the rails is made with the usual fishplate and an electrical joint of 50 m.m. copper wire, electrical thermit welding such as is used in America and England not being practised in China as yet owing to the lack of equipment and skilled workmen. It is very unfortunate that the surfacing between the tracks is not of better quality, the stone from the western hills quarries proving to be somewhat soft and yielding very rapidly to motor traffic, while the harder stone which has been employed in some parts of the work does not amalgamate well with that of the road previously constructed by the municipality. It would appear that some difficulty may arise on this point, for the understanding is that the tramway company is responsible for maintenance only on the portion of road occupied by their track, which will result in dual repair work being undertaken with an inefficient joint resulting at the point of contact.

It is obvious that there must always be troubles encountered in such an undertaking, where a modern enterprise is grafted onto the organization of an ancient city, and this is the case in more ways than one in Peking, for not only have the ancient and uncharted city sewers put in by Chien Lung cropped up here and there to obstruct the track work, but the old wooden pailous which have ornamented the streets for so long have proved to be too low and too narrow to permit of the passage of the tram traffic, and in two cases at Hsi Tan pailou and Tung Tan pailou they have had to be removed altogether. This traffic difficulty has again been encountered at the passage of the city gates at Hatamen and Hsuan Men, for the gate is here so narrow that in any case it would only be possible to use a single track and this would obviously impede both the ingoing and outgoing vehicles at the same time. Added to this there is the fact that at Hatamen the track would have to cross the Peking-Mukden railway at street level, and at present it has not been possible to obtain the consent of the railway company to this, so that the tramway line has had to use a terminus both inside and outside the gate. The same thing applies to the track at Hsuan Men, only in this case it is even more difficult to operate satisfactorily from the fact that the existing road beside crossing the railway also makes a right angled turn in the approach to the city gate through a bastion, thus rendering a through line impossible without destroying a portion of the city wall, which is not likely to be approved by the authorities under the present unsettled political conditions.

Thus it will be seen that the routes as laid down on the plans and numbered from I to IV are to a certain extent provisional, and may particularly require modification in regard to route III, on which passengers will have to change cars en route to the Tartar city or *vice versâ*. The total length of the whole system is approximately thirty two kilometres, but in all over fifty kilometres of track will have been laid when the work is completed and the sidings and branches to the car sheds are put in. The sheds themselves are not yet finished owing to an error in construction on the part of the Chinese contractors, but it is estimated that they will be ready by August and will then have a capacity for one hundred and twenty cars in all, of which number sixty trailers and thirty motors are now on hand and in process of assembly. The repair sheds are in the same stage of progress and the total cost of the two buildings will be approximately $190,000. The cars to be used are the *Brill* type 21 E, and each is fitted with a 30 horsepower motor of 550-600 volts D. K. type. The brakes are both hand and electrical and are fitted by a French firm and are therefore not of the usual Westinghouse pattern.

The cars themselves are divided into two by a sliding door, the first class having a capacity of ten passengers seated and six standing in the forward portion, while the second class takes eighteen passengers seated and twelve standing in the rear part of the car. As the traffic increases the trailers will be attached to the original cars in order to cope with the extra numbers. What the fares in the different classes are to be is not yet finally decided, but it is thought that the length of a stage will be approximately six hundred metres, and from this one may make a rough estimate as to the possible cost of transportation. A rickshaw fare for the same six hundred metres in Peking would be about six coppers or slightly under ten cents a mile, and it would be necessary for the tramway company to underbid this charge if they really expect to cut out the rickshaw service, which it would seem must still be used in a number of cases owing to the fact that a large percentage of journeys do not follow the main roads altogether, but pass across them from one small hutung to another.

There will however be a considerable passenger traffic from all parts of the Tartar city to the main business centre outside Chien Men, and also from all parts of both the Chinese and Tartar cities to the railway stations at both Chien Men and Hsi Chih Men, while the theatre district in the area north west of the Temple of Heaven will doubtless be responsible for extra traffic at certain times of the day. As most of these journeys will be long distance runs where time is an essential the trams will probably take very much of the work in this direction which is at present handled by the rickshaws somewhat unsatisfactorily, leaving them the monopoly in short distance hauls where the time saving to be effected is inconsiderable.

It will be interesting to note how the receipts of the tramway company are handled a few months after opening up, for of course these receipts are primarily responsible for the payment of shares and the maintenance of the rolling stock and track, which would not seem to leave overmuch for the customary Chinese "squeeze" on the part of the various officials of the metropolis, unless, as is more than probable, the system is allowed to deteriorate slowly and surely after the manner of most foreign innovations and installations in China when they fall into the hands of the Chinese themselves.

The Tsingtao Waterworks

By I. H. Pei, M.C.E., Member, A.C.A.E.
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Paper Read Before the Association of Chinese and American Engineers

Introduction

IN 1922, the writer was attached to the commission for the rehabilitation of Shantung rights, headed by Dr. C. T. Wang, and his mission was to look after the technical side of the Tsingtao waterworks properties preparatory to receiving them from the Japanese directorship. The data presented herein are taken principally from the notes and reports collected during this investigation.

It is hoped that this paper may serve as a source of general information to the Association as well as to the general public. The important question of the extension of the supply system in the immediate future is considered; and an attempt is made to bring to the attention of the engineering profession the necessity of an adequate laboratory for water analysis.

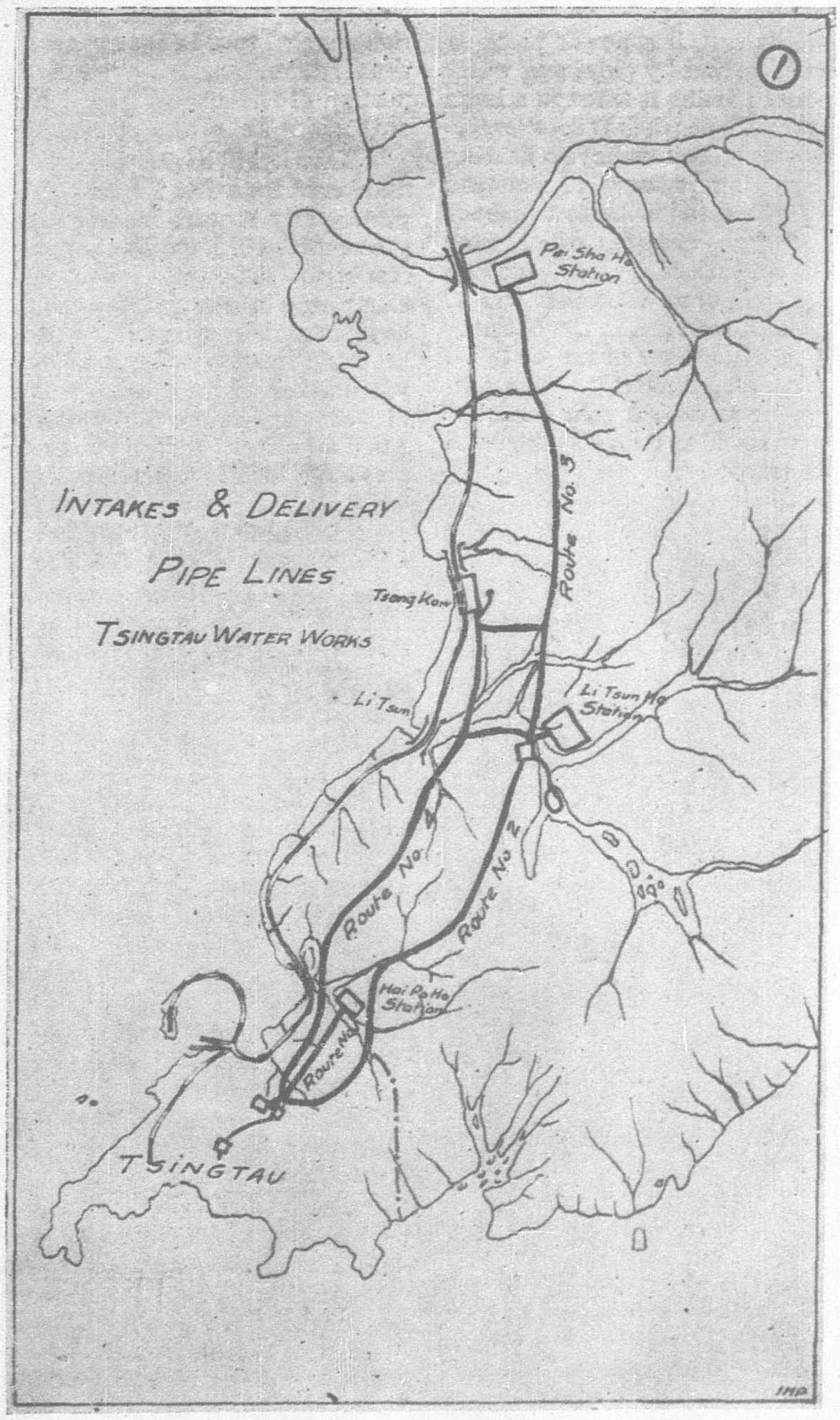
Data on the Tsingtao waterworks published in English are very meager as far as the writer knows, and he regrets that this paper is by no means a complete one.

Sources and Pumping Stations

Sandy rivers and hilly topography characterize the country about Tsingtao. On account of the heavy run-off and the enormous percolation, finding an adequate surface water supply with a reasonable investment was considered impossible. The present method of supplying water by sinking wells in the sandy river bottom or along its bank solves the problem in an exceedingly satisfactory manner. Furthermore, the water so obtained needs no treatment whatever.

It was the Germans who built up the port of Tsingtao and provided water supply for it. In 1901, the Germans discarded hundreds of unwholesome wells which they had originally sunk and built the first pumping plant at the mouth of the Hai-po River, just outside of the north boundary of the city. The pumping engines were compactly encased in thick concrete walls and slabs reinforced with steel girders. One who visited the place without previous knowledge would believe it to be one of the many fortifications—in fact it is, structurally.

There are fourteen wells with 14-in. delivery pipe (see chart route No. 1) 4,561 metres in length (2.82 miles), and the water is pumped up to the observatory hill reservoir first by two sets of gasoline engine pumps and later on by electrically operated pumps. The capacity of this equipment is about 600 cubic metres per day. The catchment area is 4.16 square miles. This station is no longer used except when called on for some emergency supply.



Map of Tsingtao Waterworks

In the course of the increasing demand due to the growth of the town, additional supply was provided from a source at Jen Chia Shan near the Li-Tsun River about seven miles from Tsingtao. Its catchment area covers 41.65 square miles—ten times that of Hai-po station. The so-called Li-Tsun station was open to service in 1908.

At the Li-Tsun station, the Germans started with 18 wells, while the Japanese increased the total number to 48. The delivery pipe-line (route No. 2, chart 1) has a diameter of 16-in. and is 11,325 metres in length to the reservoir hill. There is a new pipe-line (route No. 4) of about the same length (11,297 meters), completed in August 1922. This new duplicate line is connected to route No. 3 in the Pei Sha River station line just north of Li-Tsun station so as to increase the quantity of water to be delivered as well as to constitute a safeguard against any accidents that may occur at the Li-Tsun station or its pipe-line, route No. 2.

In November 1914, the Japanese took over Tsingtao from the Germans. The increasing population demanded additional supply and 30 wells were added to the Li-Tsun station, giving a daily yield of approximately 7,000 metric tons of water.

Since 1914, the population has become more than double the pre-war figure (124,900 in 1921 against 58,260 in 1914); so a new pumping plant was installed on the bank of the Pei Sha River near Hsien Chia Che village. The delivery pipe connecting this and the Li-Tsun station is designated as route No. 3. It has a length of 10,700 metres. Here 27 wells arranged in a single row were spaced 20 metres centre to centre and these intercept water from a catchment area of 83.3 square miles, just double that of Li-Tsun; however, the total yield is about the same in those two stations.

Pipe Line and Wells

The following table gives total length of pipe, including delivery pipes, water mains, and laterals, laid in different years :—

Year	1914	1916
length, metres	87,836.78	92,669.00
Year	1917	1918
length, metres	91,159.76	98,902.56
Year	1919	1920
length, metres	105,535 46	127,074.66
Year	1921	1922
length, metres	132,323.56	148,474.00

Macadam roads 4 metres wide and special underground telephone lines are laid above the pipe lines.

In all these stations the design of the tubular well casings is unique. The casing is 150 mm. (6-in.) in diameter. The well screen consists of a single piece of seamless brass tubing perforated by 2 x 20 mm. vertical slits. There are 9,100 slits in the 10 feet effective depth with 20 inches of tubing, unslit at the bottom, thus providing for deposits of sand and silt. Each casing is sunk into the ground or river bottom about 40-ft. deep and above each a 2-in. pipe 3 feet in length stands out to show the location of the well. The place is thickly wooded, preventing possible surface pollution.

The water from infiltration wells flows into the collecting well of 5 metres diameter and 11 metres depth whenever the ground water table is at a higher level than the siphon pipe; at other times

a vacuum pump is operated to ensure flow. The maximum yield of each well is about 250 cubic metres.

Reservoirs

From the collecting well, the water is pumped up to reservoir hill at an elevation of 68 metres above sea level. The two distribution reservoirs are of 2.000 and 4,000 metric tons capacity. The former is a German structure, the latter, Japanese.

There is one storage reservoir of 400 tons capacity on the observatory hill. This, owing to its higher elevation, is kept exclusively for the use of the observatory. The water is directly sent up from the pumping station by shutting off the reservoir hill entrance once every three months. There is also one 400 tons distributing reservoir at Tsangkew.

The reservoir of 4,000 tons capacity is built of reinforced concrete, 170-ft. by 80-ft. by 12-ft. 7-in. deep. The effective depth is 11-ft. 6-in. It is of the covered type with 66 pillars 1-ft. 5-in. square. The walls are 3-ft. 5-in. thick at top and 7-ft. 6-in. at bottom and the floor slab is 6-in. in thickness. The back filling is 3-ft. 5-in.

Consumption and Water Rates

In comparing the population and total consumption curves it is very clearly seen that the increase in consumption has gone on at a faster rate than the increase in population. The monthly curve shows seasonal variation in consumption. It shows high consumption during July, August, and September and low demand in December, January, and February of each year.

If we study the population curve with reference to that of average daily consumption, we find that the consumption per capita per day varies from 35 liters (9g.) to 80 liters, and this is largely due to four causes. First, the people are using modern toilet facilities in their houses and use water extravagantly. Secondly, the Japanese civil service men's families received special terms (e.g., Y.2.70 for a family with Y.450 salary; Y.1.00, for Y.200; Y.0.80, for Y.150 and below; Y.0.50, for Y.100 and below; Y.0.45, for common employees) and consequently they were careless about keeping the taps closed. This has been shown by statistics to account for 45 per cent. of the annual total. Thirdly, there may be enormous leakage overlooked. Lastly, the Japanese probably consume more water per capita per day than the Chinese.

The water rate is on a sliding scale basis: for 100 cubic metres or less it is 15 cents per cubic metre; over one hundred, 12 cents; above 1,000, 6 cents. The supply for ships costs 5 cents per cubic metre. For sprinkling streets sea water is used.

The total investment is Y.3,318,666—42 per cent., credited to the Germans and 58 per cent., to the Japanese. The annual income in 1921 was Y.308, 436.10, and the maintenance disbursement amounted to Y.203, 091.80, with a net income of Y.105,344.30.

Since last July, the daily consumption has run around eleven thousand metric tons. According to the waterworks census of April 1922, 130,611 people were supplied. The consumption per capita per day was 83 liters (22 gallons), a comparative high figure for this city.

Should the normal condition of the port be maintained, a greater Tsingtao is bound to be built up in the near future. Enormous amounts of public lands have been leased out in the last two years and subdivided into street lots, especially in the Tai-Si section and in the manufacturing districts of Hsiaopautao, Szefang, and Tsangkew. In the Tai-Si section alone, 25,000 people could find homes or business quarters if all lots were occupied. The writer has much confidence in predicting a population of 180,000 in 1927, or 200,000 in 1929 for greater Tsingtao.

At 22 gallons per capita, the daily consumption in 1927 would be four million gallons or 15,200 cubic metres, which is the maximum capacity of the present works. After a careful study of conditions and consideration of data collected, the writer ventures to draw the conclusion that unless new extensions be constructed either by sinking more wells at Pei Sha River station or elsewhere, the people of Tsingtao will be conpelled to do without the supply in the night time or must be instructed not to bathe too frequently in the summer months. There may be much to say about the extravagant use of water, especially by civil service men and offices, leakages, and other causes of waste due to inefficiency of management; but any improvement in these matters will not solve the problem of meeting the demand by the present supply five years from now.

Furthermore, a city should have a distribution reservoir capacity of 2 or 3 days supply if possible. On September 2, 1922, the consumption ran up to 13,094 cubic metres. The present capacity (6,000 cubic metres) could only meet 13 hours demand upon the basis of average daily consumption.

If a fire stream discharge one cubic metre per minute, only 6 streams could be operated at one time for 6 hours with September 2 consumption rate. We have few other sources of water supply in case of accident to the Li-Tsun or the Pei Sha River stations. Such failure means cutting down our present supply nearly one half. The reservoirs are too small to make up such deficiencies even for the very near future. It is therefore recommended that the present unit be doubled by constructing more distributing reservoirs, preferably at a lower elevation.

A New Laboratory

Here in Tsingtao, we are enjoying all modern conveniences, such as good roads, a modern sewage system, and natural potable water. From past records we find that the water is of normal hardness (about 50 p.p.m.), such as we usually expect from unpolluted ground water, wells, and filter galleries. Chlorine is a little too high, but this may be due to the location on the sea coast.

Since last year the water has not been well taken care of, and at present there is no laboratory to do the analysing. And it is not satisfactory to have a laboratory, which requires the direction of a sanitary engineer, entrusted to a hospital as the Japanese did in the previous years. The writer recommends a new independent small sanitary engineering laboratory, free from politics. He has drawn up a detailed estimate and complete list of apparatus required, but when his plan can be realized, no one can tell.

Physical, Chemical, and Bacteriological Analyses

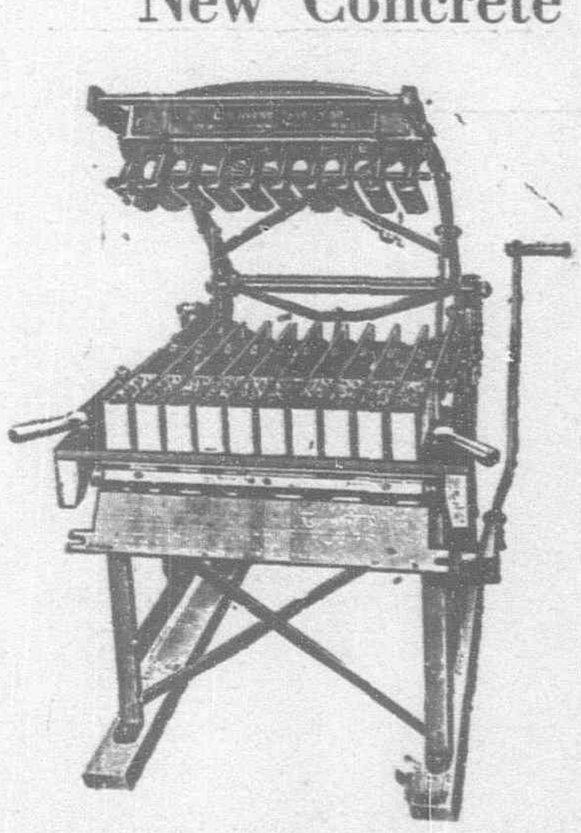
(Tsingtao Water Works)

	1915	1916	1917	1918	1919	1920	1921
Color	nil	nil	nil	nil	nil	nil	nil
Odor	nil	—	—	—	—	—	—
Solid suspended matter p.p.m.*	236.5	167.4	204.0	214.3	209.0	200.9	168.4
Hardness, German degrees†	7.07	6.70	7.20	3.80	2.98	3.03	2.77
Chlorine, p.p.m.	68.5	64.7	65.66	50.54	59.29	59.60	49.20
Oxygen consumed, p.p.m. ...	1.2	1.4	1.2	0.92	0.96	0.90	0.82
Nitrogen p.p.m.:							
As ammonia	nil	—	—	—	—	—	Trace
As nitrites	nil	—	—	—	—	—	Trace
As nitrates	nil	Trace	Trace	—	—	Trace	Trace
Bacteria, per c.c.	—	—	155	143	112	102	81

*p.p.m. signifies parts per million or miligrams per liter.

†Hardness in German degrees designate parts of CaO in 100,000. To convert into p.p.m. of CaCO multiply by 17.8

New Concrete Block Machine



THE latest invention in the line of concrete machinery is the Wert Process, a machine which will manufacture concrete bricks of any color desired, face up, on a wooden pallet.

The facing or composition is a patented article combined with the Portland cement and making them absolutely waterproof. The bricks are manufactured on a wet process, 1⅓ yards sand and 7 sacks cement manufacture 1,000 bricks. The machine will manufacture plain, faced or tapestry brick without any changes.

Extend Acid Industry

Demand for sulphuric acid expanding rapidly beyond 20,000,000 pounds a month, Japanese sulphuric acid manufacturers who have been worried by bad prospects are now delighted. Some who left lead chambers idle are repairing them while others are erecting new ones. This change for the better is especially pronounced in Osaka. The Osaka Metal Smelting company has just erected a new lead chamber. The Ito Sulphuric Acid and Soda company has installed two additional condensing furnaces.

Other fertilizer or chemical companies have repaired their idle plants and soon the demand for 65 per cent. acid will be met. No step has been taken yet for increasing production of strong acid. Demand for 66 per cent. is only half met at present. With this in view the Osaka Alkali Works have installed two more condensing furnaces. The Rhasa Island Phosphate company is stated to be installing one. The Nankai Bleaching Powder company has had two furnaces idie, which the company will repair and put in blast again soon.

Mukden Tram Scheme Held Up

Gov. Wang Yung-kiang, of Fengtien, has demanded of Japanese Consul-General Funatsu, Mukden, the abolition of the Mukden Horse Car Co. under Sino-Japanese management. This demand is grounded on the expiry of the term, but it is suspected to be connected somehow with the new Mukden tramway scheme. An understanding was entered into some time ago between Governor Wang and the Okura Company, to construct an electric tram system for Mukden under Sino-Japanese joint management. The Chinese now seem desirous of operating the trams on their own account.

The South Manchuria Railway Co., in view of the negotiations between the Chinese and the Okura's for the conversion of the horse tram to an electric tram system, has held off from laying an electric tram in the railway town and now the joint management scheme is stoutly opposed by the Chinese municipal administration and the governor. Officials of the Railway Company do not favor constructing a tramway for the railway town alone, for great inconvenience will be met with in connecting it with the Chinese system, that is bound to be established in the city of Mukden. In the second place, even the current expense of such a project is not likely to be repaid, aside from the redemption of the investments on capital account. The plan may have to be abandoned owing to lack of co-operation and open opposition by the Chinese.

To Probe Sungari Conditions

The ministry of communications has dispatched Mr. John E. Baker, an American, who has served as adviser to the ministry for many years, to proceed to Harbin to investigate the conditions of navigation of the Sungari River. Mr. Baker is also instructed to look into the railway conditions in the three eastern provinces.